ALTERNATIVE TRANSPORTATION SCENARIOS AND STAGING CEILINGS

A BACKGROUND REPORT FOR THE FY89 AGP

by the
Montgomery County Planning Department
The Maryland-National Capital Park and Planning Commission

December, 1987

ALTERNATIVE TRANSPORTATION SCENARIOS

AND STAGING CEILINGS

A Backgound Report to the FY '89 Annual Growth Policy

Prepared by the:

Montgomery County Planning Department

THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION
Montgomery County Planning Board
8787 Georgia Avenue
Silver Spring, Maryland 20910-3760

December 1987

ABSTRACT

TITLE: Alternative Transportation Scenarios and Staging Ceilings

AUTHOR: The Maryland-National Capital Park and Planning Commission, Transportation Planning Division

SUBJECT: FY 89 Annual Growth Policy Background Report on Transportation

PLANNING AGENCY: The Maryland-National Capital Park and Planning Commission
8787 Georgia Avenue
Silver Spring, MD 20910-3760

DATE: December, 1987

SERIES NUMBER: 0678872502

NUMBER OF PAGES:

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CHAPTER 1

RELATIONSHIP TO THE

FY89 ANNUAL GROWTH POLICY

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RELATIONSHIP TO THE FY 89 ANNUAL GROWTH POLICY

This report is one of a series of planning studies, which provide background information relevant to the Annual Growth Policy (AGP) for FY 89. They are not part of the AGP itself, but provide reference material which may be useful, as the AGP moves from its initial draft by the Planning Department through Planning Board review and County Executive revision to County Council adoption.

This particular report deals with transportation matters. Specifically this report focuses on several areas which are immediately relevant to the final draft FY 89 AGP: (1) Alternative Transportation Scenarios (Chapter 2); (2) Alternative Transportation Staging Ceilings (Chapter 3); (3) Standards of Transportation Level of Service (Chapter 5); (4) Alternative Measures of Level of Service (Chapter 6); and (5) Modeling Policy Area Level of Service (Chapter 7).

The first part of Chapter 2 presents the alternative transportation scenarios which have been considered in the final draft FY 89 AGP. Five scenarios are shown in addition to the capital improvements which have been relied upon in the adopted FY 88 AGP. These five scenarios are: (1) the <u>FY 89 Anticipated</u>; the fifth year of the current CIP becoming the fourth year of the FY 89 CIP, (2) <u>Augmented A</u>; based upon adding to Scenario 1 some additional projects being considered by MCDOT, (3) <u>Augmented B</u>; based upon adding to Scenario 2 one more set of improvements, (4) <u>FY 88 Revised Test of Subdivision (RTAS)</u>; a set of projects through FY 94 that meet criteria outlined in the recommendations of the Test at Permit Committee, and (5) <u>FY 89 RTAS</u>; a set of projects through FY 95 that similarly meet the criteria. A table is presented which shows which of the potential projects that could be part of the different scenarios where included as having firm and reliable schedules.

Chapter 2 also contains an extensive description of what are called "Mid-Term Traffic Alleviation Measures." They are called "Mid-Term" measures, to reflect the fact that they build on, and are in addition to, the measures approved by the Council in October 1986, under the Short-Term Traffic Alleviation Policy (i.e., originally called Interim Growth Policy). These measures are referenced in the AGP Staff Draft, but no estimate of their potential effect on traffic congestion is included there, because it requires further study. The traffic alleviation measures described herein do not exhaust the full range of possibilities, but are recommended by the Planning Department to be considered for inclusion in the FY 89 CIP and Operating Budget (OB).

Chapter 3 gives the alternative staging ceilings, based on the five scenarios identified above. They are also shown graphically in both this report and the AGP Staff Draft as a set of charts for each policy area within the County. Chapter 3 herein adds a page of description to each one, outlining the Planning staff's perception of not only the current transportation conditions, but also some potential transportation improvements which could be made in the near future.

Chapter 4 analyzes the local and State transportation programs with regard to historic and budgeted funding levels. The analysis shows that the State Highway funds being budgeted for projects in Montgomery County will result in the County receiving what appears to be an appropriate proportion of the State gas tax revenue increase of this past Summer. Recommendations are also presented regarding (a) projects which should have priority for initiation of Project Planning Studies by the State Highway Administration and (b) new projects which should be given consideration by the Executive for inclusion in the latter years of the Recommended FY 89-94 CIP.

The four remaining chapters cover various aspects of the methodologies and procedures which are integral parts of the AGP process and the administration of the Adequate Public Facilities Ordinance (APFO) by the Planning Board. Chapter 5 discusses the standards of transportation average Level of Service (LOS) that are used in the AGP and includes estimates of current local and average LOS conditions. Chapter 6 presents alternative measures of LOS including transit's effect on transportation capacity. This chapter in particular has been prepared in response to the Council's requests for analyses and recommendations on a number of issues, including these transportation related ones. Chapter 7 covers the topic of transportation modeling by giving (a) an overview of how computerized transportation planning models work, (b) the key differences between the New EMME/2 model and the previous TRIMS model and (c) the calibration of the new model. Chapter 8 contains the specific APFO Guidelines of the Planning Board for conducting Local Area Transportation Reviews. A technical appendix has also been included which has maps showing the results of the initial study of automobile travel times to and from major employment centers in Montgomery County which was conducted in September, 1986.

In summary, this background report for the FY 89 AGP 1) identifies the alternative scenarios, 2) gives the resulting staging ceilings and recommendations on new transportation projects for inclusion in the capital programs, and 3) presents information regarding the methods, procedures and assumptions which underlie the analyses for the AGP and the administration of the APFO.

CHAPTER 2

ALTERNATIVE TRANSPORTATION SCENARIOS

INCLUDING
MID-TERM TRAFFIC ALLEVIATION MEASURES

CHAPTER 2

ALTERNATIVE TRANSPORTATION SCENARIOS INCLUDING MID-TERM TRAFFIC ALLEVIATION MEASURES

The Staff Draft Annual Growth Policy (AGP) considers different transportation facility and service improvement alternatives. To keep track of the different alternatives considered in the report, a series of maps and lists of alternative transportation improvements have been prepared. This series of maps and lists is organized into three basic groupings: highway improvements, transit improvements, and traffic alleviation measures. A brief discussion follows identifying the different alternatives used in this report.

A. HIGHWAY CAPITAL IMPROVEMENTS:

There are three basic sets of alternative highway improvements used in this AGP. The first is shown in Table 2.1 and on the corresponding Map 2.1. The adopted staging ceilings for FY 88 have been calculated based upon this set of projects taken in conjunction with the programmed transit projects given below. This set shows the highway improvement projects which are 100 percent programmed for construction in the first four fiscal years in the Montgomery County FY 88-93 Capital Improvements Program (CIP) or the Maryland Department of Transportation FY 87-92 Consolidated Transportation Program (CTP). Also shown in Table 2.1 are the Highway improvements that qualify to be considered in Local Area Review test for subdivision that have submitted Preliminary Plans for approval. The list indicates the roadway projects within each policy area, which group is implementing each project, and the limits of each project. Reference Map 2.1 shows that there is a high concentration of highway projects in the I-270 Corridor, particularly in the Gaithersburg West area.

Map 2.2 presents the set of road improvement projects which have been used to develop the FY 89 Anticipated Staging Ceiling. These projects represent those transportation projects which are currently scheduled to be completed in the fifth fiscal year of the adopted FY 88-93 CIP or equivalent CTP. Under normal circumstances, they will be completed in the fourth fiscal year of the new CIP which will be adopted for FY 89-94. These transportation projects are also shown in Table 2.2 in the Column that identifies projects that will have 100% of their construction expenditures available in FY 92. One exception is the Germantown-Montgomery Village Avenue Connector project which has been judged as not having a firm and reliable enough schedule to be considered at this time in accordance with the proposed procedures for the Revised Test at Subdivision approach.

TABLE 2.1: LIST OF HIGHWAY PROJECTS BY POLICY AREA WHICH ARE 100% PROGRAMMED FOR CONSTRUCTION IN THE FIRST FOUR YEARS OF THE FY 88-93 CIP, THE CITY CIP'S, OR THE MDDOT FY 87-92 CONSOLIDATED TRANSPORTATION PROGRAM

Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	Approved Road Program of 7/1/87	100% of Con[s] Expenditure[s]
BETHESDA	--	153268	1.	<u>Wisconsin Avenue (MD 355)</u> Bridge over the Georgetown Branch	Replace Bridge	Y	88
	--	151009	2.	<u>I-495 Widening (Capital Beltway)</u> Wisconsin Avenue (MD 355) to Georgia Avenue (MD 97)	+2 Lanes	Y	90
	1337	733696	3.	<u>Woodmont Avenue Extended</u> Montgomery Lane to Leland Street	4 Lane Business Street	Y	88
	1266	793369	4.	<u>The Hills Plaza Connection</u> Extension North	4 Lane Business Street	Y	88
CLOVERLY	1342	863119	5.	<u>Ednor Road Bridge</u> Northwest Branch	2 Lane Bridge	N	89
	1251	673940	6.	<u>Bonifant Road</u> Layhill Road (MD 182) to New Hampshire Avenue (MD 650)	Safety Widening	Y	90
	1297	863115	7.	<u>MD 28 - MD 198 Connector</u> Layhill Road (MD 182) to New Hampshire Avenue (MD 650)	2 Lanes	Y	91
DAMASCUS	--	Special Projects	8.	<u>Ridge Road (MD 27)</u> Lewis Drive to Main Street (MD 108)	Geometric Improvements	Y	88
	1668	859117	9.	<u>Lewis Drive</u> Main Street (MD 108) to MD 27	2 Lanes	Y	88
	1325	873121	10.	<u>Sweepstakes Road</u> Ridge Road (MD 27) to Woodfield Road (MD 128)	Residential Primary	N	90
FAIRLAND/WHITE OAK	1328	823862 (Joint with County)		<u>Columbia Pike (US 29)</u>			
			11.	Section I: Industrial Parkway to Randolph Road	+2 Lanes	Y	89
			12.	Section II: North of Fairland Road to Greencastle Road	+2 Lanes	Y	89
		Special Projects	13.	New Hampshire Avenue (MD 650) to Industrial Parkway and Greencastle Road to North of Sandy Spring Road (MD 198)	+2 Lanes	Y	89
	1262	833963	14.	<u>Fairland Road</u> Randolph Road to Old Columbia Pike	Safety Widening	Y	90
	1259	833888	15.	<u>E. Randolph Road Widening</u> Phase I: New Hampshire Avenue (MD 650) to Fairland Road	+4 Lanes	Y	91
	1258	833969	16.	<u>E. Randolph Road Widening</u> Phase II: Fairland Road to Old Columbia Pike	+3 Lanes	N	91
	1253	873114	17.	<u>Briggs Chaney Realignment East</u> Old Columbia Pike to Briggs Chaney Road	2 Lanes	N	91

TABLE 2.1 (continued)

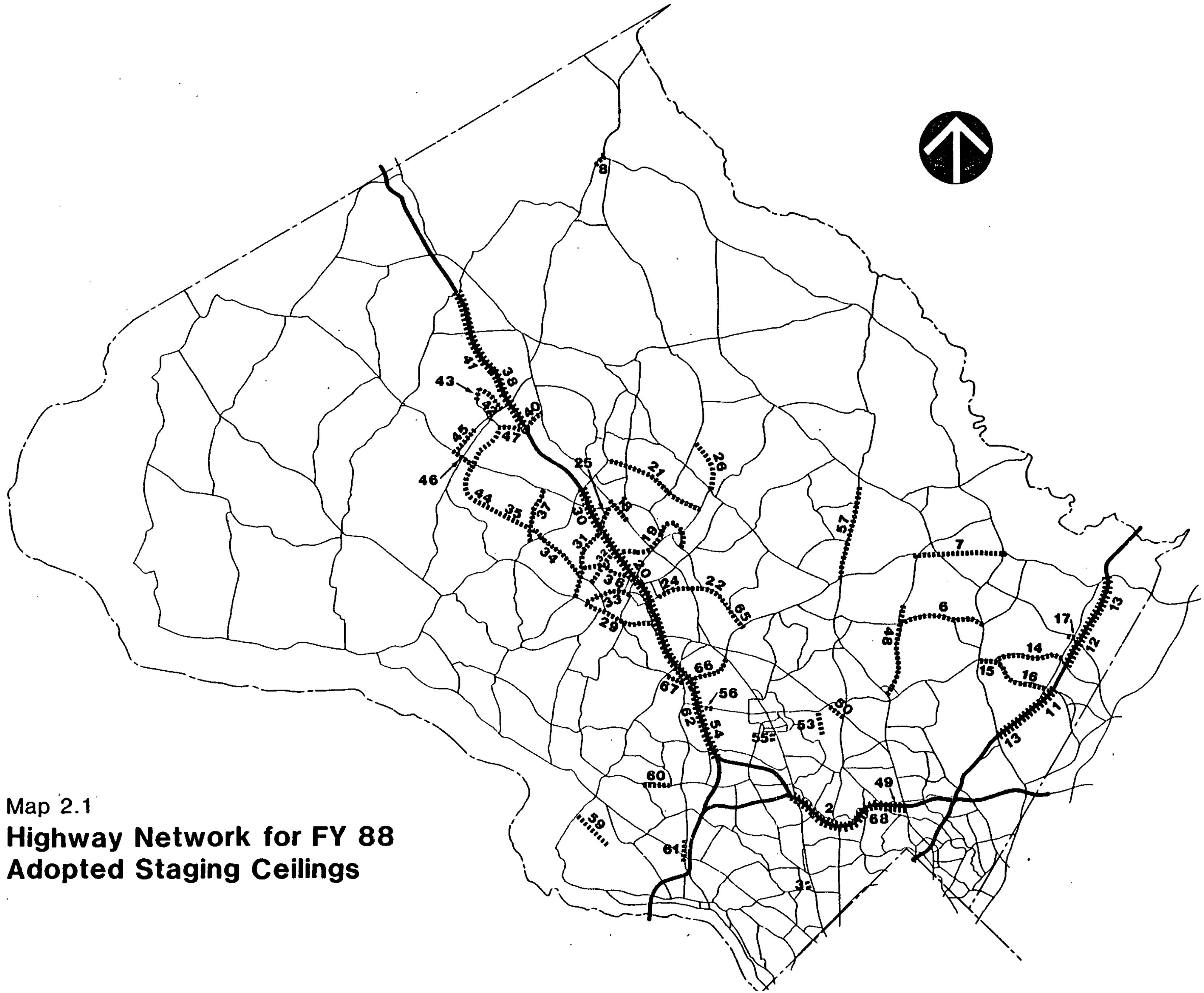
Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	Approved Road Program of 7/1/87	100% of Const. Expenditures By
GAITHERSBURG EAST	--	153162	18.	Frederick Avenue (MD 355) S. Summit Avenue to Chestnut Street	6 Lane Bridge	Y	88
	--	151015	19.	I-370 Metro Connection I-270 to Shady Grove Metro Access Road	6 Lane Freeway	Y	90
	--	151024	20.	I-270 Widening Montgomery Village Avenue (MD 124) to Shady Grove Road	+2 Lanes, CD Road	Y	90
	--	153065	21.	Mid-County Highway Widening (MD 115 Relocated) Montgomery Village Avenue to Shady Grove Road	+2 Lane Divided	Y	90
	1282	793177	22.	Gude Drive Widening MD 355 to Southlawn Lane	+4 Lanes +3 Lanes	Y	90
	1343	763815	23.	Gude Drive Railroad Bridge Over B&O and Metro Tracks	+3 Lanes	Y	89
	1283	723271	24.	Gude Drive Extension, Phase II Piccard Drive to Frederick Avenue (MD 355)	+2 Lanes	N	89
	1308	663899	25.	Muddy Branch Road/W. Diamond Avenue I-270 to W. Diamond Avenue (MD 117)	+2 Lanes	N	90
	1248	853176	26.	Airpark Road/Shady Grove Road Extended Muncaster Mill Road (MD 115) to Laytonsville Road (MD 124)	4 Lanes	Y	90
	1331	853137	27.	Watkins Mill Road - School Access	4 Lane Undivided	Y	91
	1346	823754	28.	Watkins Mill Road Bridge Whetstone Run Stream	+2 Lanes	N	91
GAITHERSBURG WEST	--	153332	29.	MD 28 Widening Research Boulevard to Key West Avenue	+2 Lanes	Y	88
	--	151024	30.	I-270 Widening Montgomery Village Avenue (MD 124) to Shady Grove Road	+2 Lanes CD Roads	Y	90
	1308	663899	31.	Muddy Branch Road Darnestown Road (MD 28) to I-270	+2 Lane Divided	N	90
	1316	853122	32.	Sam Eig Highway Great Seneca Highway to I-270	6 Lane Divided	Y	91
	1289	803530	33.	Key West Avenue - MD 28, Phase III Darnestown Road (MD 28) to Shady Grove Road	+4 Lanes +2 Lanes	Y	91
	1280	713129	34.	Great Seneca Highway, Phase II Quince Orchard Road (MD 124) to Darnestown Road (MD 28)	4 Lane Divided	Y	91
	1278	863111	35.	Great Seneca Highway, Phase III Great Seneca Creek to Quince Orchard Road (MD 124)	4 Lane Divided	Y	91
	1264	663907	36.	Fields Road Muddy Branch Road to Omega Drive	4 Lanes, 5 Lanes	Y	91
	1291	743799	37.	Longdraft Road/Clopper Road Quince Orchard Road (MD 124) to Clopper Road (MD 117)	+2 Lanes	N	91

TABLE 2.1 (continued)

Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	Approved Road Program of 7/1/87	100% of Cons Expenditures
GERMANTOWN EAST	--	151024	38.	I-270 Widening and Middlebrook Road Interchange	+2 Lanes, New Interchange	Y	91
	1331	853137	39.	Watkins Mill Road - School Access	4 Lane Undivided	Y	91
	1302	863125	40.	Middlebrook Road Phase II: I-270 to Frederick Road (MD 355)	+2 Lanes	N	Developer
GERMANTOWN WEST	--	151024	41.	I-270 Widening and Middlebrook Road Interchange	+2 Lanes, New Interchange	Y	91
	1255	873160	42.	Crystal Rock Drive Germantown Road (MD 118) to Germantown Drive	4 Lanes	Y	87
	1273	873161	43.	Germantown Drive Widening Crystal Rock Drive to Wynnfield Drive	+2 Lanes	Y	88
	1278	863111	44.	Great Seneca Highway, Phase III Middlebrook Road to Great Seneca Creek	4 Lanes	Y	91
	1293	863171	45.	MD 118 Relocated/Germantown Road Phase I: Wisteria Drive to Clopper Road	6 Lanes	Y	90
	1299	873119	46.	MD 117 Widening (Clopper Road) MD 118 Relocated to Great Seneca Highway	+2 Lane Divided	N	91
	1302	863125	47.	Middlebrook Road, Phase I Great Seneca Highway to I-270	+2 Lane Divided	N	91
KENSINGTON/WHEATON	--	153011	48.	Layhill Road Widening Georgia Avenue (MD 97) to Longmead Road	+2 Lane Divided	Y	90
	--	153181	49.	Forest Glen Road (MD 192) Georgia Avenue (MD 97) to Belvedere Place	2 Lanes	N	90
	--	Special Projects	50.	Veirs Mill Road Randolph Road to Connecticut Avenue (MD 185)	+2 Lanes	Y	88
	1399E	873183	51.	Glenmont Park and Ride Lot Georgia Avenue (MD 97) & Glenallan Avenue	300 Spaces	-	88
	1250	803498	52.	Belvedere Place Extension from Forest Glen Road (MD 192)	Residential Primary	Y	89
	1257	883102	53.	Dewey Road Dahill Road to Garrett Park Road	Residential Primary	N	91
NORTH BETHESDA	--	151024	54.	I-270 Widening Y Split to Montrose Road	+2 Lanes, CD Roads	Y	90
	1334	853136	55.	Woodglen Drive Nicholson Lane to Security Lane	4 Lanes	Y	88
	1306	813591	56.	Montrose Road Extension Phase III: Westmont Blvd. to Old Bridge Road	+2 Lanes	N	88
OLNEY	1267	823864	57.	Georgia Avenue (MD 97) Norbeck Road (MD 28) to MD 108	4 Lane Divided	Y	89
	1252	783018	58.	Briars Road Connection to Olney-Laytonsville Road (MD 108)	Residential Primary	Y	90

TABLE 2.1 (continued)

Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	Approved Road Program of 7/1/87	100% of Const. Expenditures By
POTOMAC	1311	863131	59.	Oaklyn Drive Falls Road to Potomac	Arterial Road	Y	89
	1256	813595	60.	Democracy Boulevard Extension Gainesborough to Kentsdale	2 Lanes	Y	89
	1318	863110	61.	Seven Locks Road Phase I: South of River Road to Dwight Drive	Safety Widening	N	90
ROCKVILLE	--	151024	62.	I-270 Widening Montrose Road to Shady Grove Road	+2 Lanes, CD Roads	Y	90
	--	151033	63.	Falls Road (MD 189) Interchange Interchange with I-270	New Interchange	Y	90
	--	151035	64.	I-270 New Bridge at Ritchie Parkway	4 Lanes	Y	89
	--	6S-11	65.	Gude Drive Southlawn to MD 28	+2 Lanes	Y	89
	1314	823865	66.	Ritchie Parkway (1) Seven Locks Road to Rockville Pike (MD 355)	4 Lanes	N	90
	--	6E-11	67.	Ritchie Parkway (2) Falls Road (MD 189) to Seven Locks Road	+2 Lanes	N	88
SILVER SPRING/ TAKOMA PARK	--	151009	68.	I-495 Widening (Capital Beltway) Wisconsin Avenue (MD 355) to Georgia Avenue (MD 97)	+2 Lanes	Y	90



Map 2.1
Highway Network for FY 88
Adopted Staging Ceilings

TABLE 2.2: LIST OF TRANSPORTATION PROJECTS BY POLICY AREA AND POSSIBLE FISCAL YEAR OF IMPLEMENTATION

M-NCPPC 11/20/87

Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	100% of Construction Expenditures by					
						FY 92	FY 92 Augmented	FY 93	FY 94	FY 95	FY 95+
BETHESDA	--	151087	1.	I-495 Widening (Capital Beltway) Potomac River to River Road (MD 190)	+2 Lanes	X					
	1266	793369	2.	Friendship Boulevard Willard Avenue to Western Avenue	3 Lanes						X
CLOVERLY	--	153337	3.	New Hampshire Avenue (MD 650): Phase II Randolph Road to Spencerville Road (MD 198)	Under Design		A				X
	--	154002	4.	Intercounty Connector Norbeck Road (MD 28) to Columbia Pike (US 29)	Under Design						X
DAMASCUS	1295	883105	5.	MD 124 Extension Main Street (MD 108) to Ridge Road (MD 27)	2 Lanes			X			
FAIRLAND/WHITE OAK	--	15REV3	6.	US 29 Widening Bridge over New Hampshire Avenue (MD 650)					NC		
	--	15REV2	7.	Intercounty Connector US 29 to I-95	Under Design				X		
	--	154002	8.	Intercounty Connector Norbeck Road (MD 28) to Columbia Pike (US 29)	Under Design						X
	--	153337	9.	New Hampshire Avenue (MD 650): Phase I Randolph Road to Spencerville Road (MD 198)	Under Design		A			X	
	--	152019	10.	US 29 Improvement Study I-495 to Howard County	Under Study						X
	1254	883103	11.	Briggs Chaney Road Widening Automobile Boulevard to ICC Alignment	+2 Lane Divided				X		
	1326	873122	12.	US 29 HOV I-495 to Sandy Spring Road (MD 198)	Reversible Median Lane				NC		
GAITHERSBURG EAST	--	154002	13.	Intercounty Connector I-370 to Shady Grove Road	Under Design			X			
	1269	863116	14.	Germantown/Montgomery Village Connector	Under Study	NC					
	1284	863117	15.	Intercounty Connector Shady Grove Road to Norbeck Road (MD 28)	4 Lane Divided			X			
	1296	873113	16.	MD 124/Shady Grove Connector Railroad Street to Crabbs Branch Way Extension	2 Lanes			X			
	1276	883101	17.	Goshen Road O'dend'hal Road to Warfield Road	+2 Lane Divided			X			
	1304	883106		Montgomery Village Avenue/Wightman Road							
			18.	a. Montgomery Village Avenue Lost Knife Road to Wightman Road	+2 Lanes			NC			
			19.	b. Wightman Road Montgomery Village Avenue to Goshen Road	+2 Lanes			X			
	1332	883109	20.	Watkins Mill Road Extended Clopper Rd (MD 117) to Frederick Ave (MD 355)	5 Lane Arterial			X			
	1399F	883190	21.	Shady Grove Metro Parking Phase II: East Parking Garage Addition	800 Spaces	X					

X = Counted in the Year Shown; A = Augmentation to the FY 92 Network
NC = Not Counted Due to the Completion Schedule Not Being Firm and Reliable

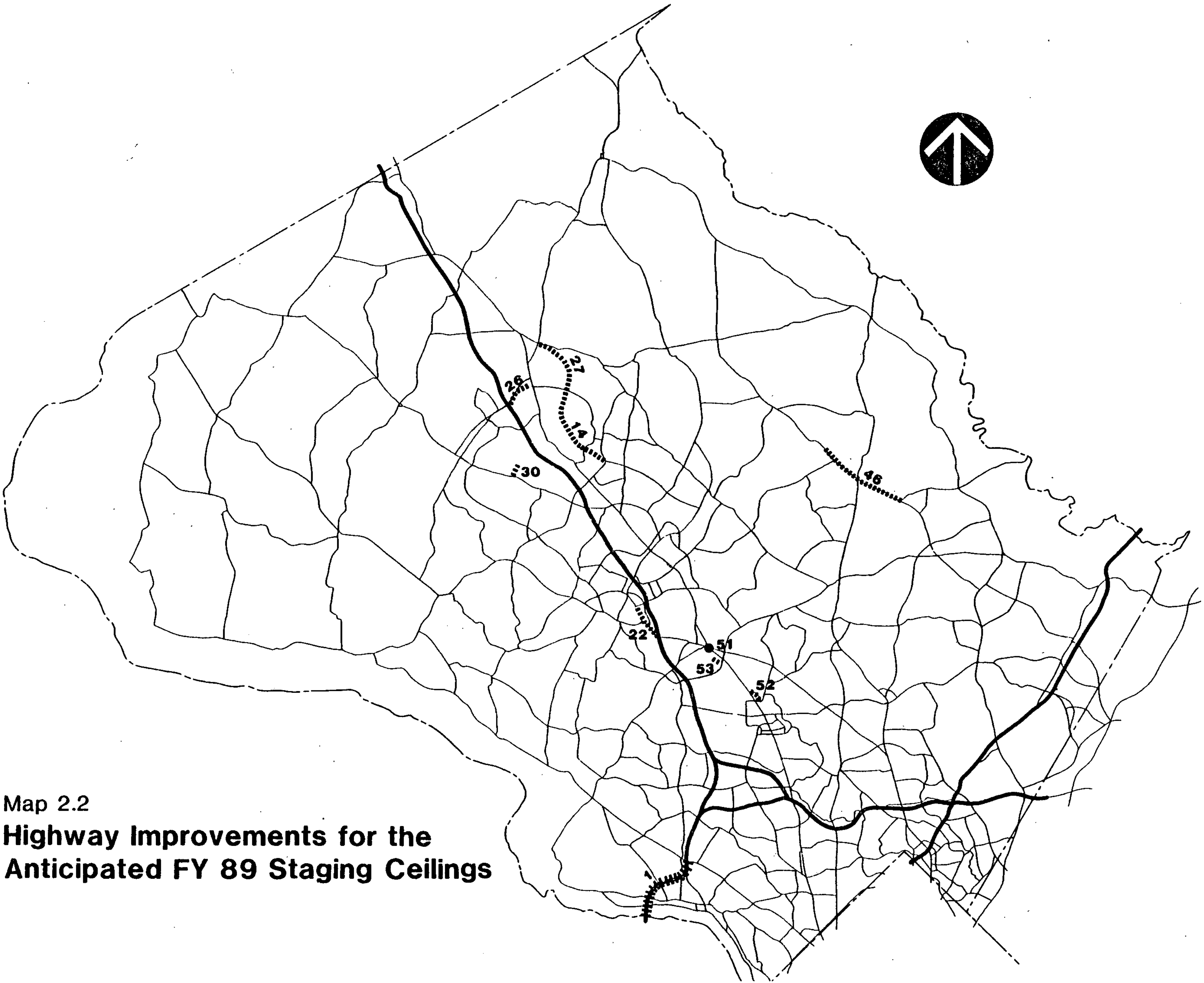
Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	FY 92	FY 92 Augmented	FY 93	FY 94	FY 95	FY
						100% of Construction Expenditures by					
GAITHERSBURG WEST	--	153324		MD 28 Relocation and Widening							
			22.	a) I-270 to Key West Avenue	Under Design	X					
			23.	b) Key West Avenue to Jones Lane	Under Design				X		
			24.	c) Quince Orchard Road (MD 124)	Under Design				X		
	1332	883109	25.	Watkins Mill Road Extended Clopper Road (MD 117) to Frederick Avenue (MD 355)	5 Lane Arterial			X			
GERMANTOWN EAST	1293	863171	26.	MD 118 Relocated (Germantown Road) Phase II: I-270 to MD 355	+4 Lanes	X					
	1269	863116	27.	Germantown/Montgomery Village Connector	Under Study	NC					
	1271	873115		Germantown Drive and Interchange							
			28.	a) Germantown Drive Interchange	Interchange,		A		NC	X	
			29.	b) Germantown Drive: Phase I	2 Lanes		A	X			
				c) Germantown Drive: Phase II	4 Lanes		A			X	
				d) Germantown Drive: Phase III	6 Lanes		A				X
GERMANTOWN WEST	1330	883108	30.	Waring Station Road Clopper Road (MD 117) to B & O RR	4 Lane Arterial	X					
	1293	863171	31.	MD 118 Relocated/Germantown Road Phase III: Clopper Road to Riffleford Road	4 Lanes				X		
	1271	873115		Germantown Drive and Interchange							
			32.	a) Germantown Drive Interchange	Interchange		A		NC	X	
			33.	b) Germantown Drive: Phase I	2 Lanes		A	X			
				c) Germantown Drive: Phase II	4 Lanes		A			X	
				d) Germantown Drive: Phase III	6 Lanes		A				X
	1399L	763644	34.	Germantown Commuter Rail Station Phase III Parking	250 Spaces				X		
KENSINGTON/WHEATON	--	152019	35.	US 29 Improvement Study I-495 to Howard County Line	Under Study						X
	--	15REV3	36.	US 29 Widening Interchange at MD 193 (Four Corners)	Grade Separation				NC		
	--	154002	37.	Intercounty Connector Norbeck Road (MD 28) to Columbia Pike (US 29)	Under Design						X
	13990	773954	38.	Glenmont Metrorail Line Extension to Glenmont	Station at Glenmont						X
	1274	813592	39.	Glenallan Avenue Georgia Ave (MD 97) to Layhill Road (MD 182)	+1 Lane						X
	1275	793179	40.	Glenmont Yard Access Road Layhill Road (MD 182) to Metrorail Yard	2 Lanes						X

X = Counted in the Year Shown; A = Augmentation to the FY 92 Network
NC = Not Counted Due to the Completion Schedule Not Being Firm and Reliable

TABLE 2.2 (continued) M-NCPPC 11/20/87

Policy Area	PDF No.	Project No.	Map No.	Project Name (Underlined) with Phases and/or Limits	Scope of Improvement	100% of Construction Expenditures by FY 92	FY 92 Augmented	FY 93	FY 94	FY 95	FY 95+
NORTH BETHESDA	--	151105	41.	<u>I-270: East Spur</u> Y Split to I-495	+2 Lanes (Under Study)		A		X		
	--	151104	42.	<u>I-270: West Spur</u> Y Split to I-495	+2 Lanes (Under Study)		A			X	
	--	153364	43.	<u>Rockville Pike (MD 355) at</u> Montrose/Randolph Roads and B&O RR	Grade Separation						X
	1261	813594	44.	<u>Edson Lane</u> Rockville Pike (MD 355) to Woodglen Drive	Residential Primary			NC			
	1344	813691	45.	<u>I-270 Overpass</u> Westlake to Fernwood Road	2 Lanes						X
OLNEY	--	--	46.	<u>Olney-Sandy Spring Road (MD 108)</u> Olney Mill Road to Dr Bird Road	+2 Lanes	X					
	1284	863117	47.	<u>Intercounty Connector</u> Shady Grove Road to Norbeck Road (MD 28)	4 Lanes			X			
POTOMAC	--	15New1	48.	<u>Falls Road (MD 189)</u> River Road to Ritchie Parkway	Project Planning Study						X
	1318	863110	49.	<u>Seven Locks Road</u> Phase II: Dwight Drive to Bradley Boulevard	Safety Widening			X			
	1344	813691	50.	<u>I-270 Overpass</u> Westlake-Fernwood	2 Lanes						X
ROCKVILLE	--	6H11	51.	<u>MD 355/MD 28 Intersection Improvement</u>	+2 Lanes on MD 355	X					
	--	8B11	52.	<u>Chapman Avenue</u> Halpine Road to Rockville Pike (MD 355)	4 Lanes	X					
	--	8C11	53.	<u>Fleet Street</u> Richard Montgomery Drive to Ritchie Parkway	4 Lanes	X					
	--	8D12	54.	<u>Jefferson Parkway</u> Ritchie Parkway to East Jefferson Street	4 Lanes			X			
	--	8F11	55.	<u>Rockville Pike Corridor Grid Streets</u>		X					
	--	8E11	56.	<u>Montrose-Jefferson Bypass</u> Montrose Road to East Jefferson Street	4 Lanes			NC			
SILVER SPRING/ TAKOMA PARK	1322	873116	57.	<u>Silver Spring Roadway Improvements</u> (Specific improvements still to be selected)	Under Study						X

X = Counted in the Year Shown; A = Augmentation to the FY 92 Network
NC = Not Counted Due to the Completion Schedule Not Being Firm and Reliable



Map 2.2
Highway Improvements for the Anticipated FY 89 Staging Ceilings

Map 2.3 presents the set of road improvement projects, which have been used to develop the Augmented FY 89 Staging Ceiling alternative as well as projects shown on Map 2.2. These highway improvement projects were identified by the County Executive and MCDOT as projects that could possibly be expedited so that they would also be completed within the first four years of the FY 89-94 CIP or CTP. These projects are shown on Table 2.2 under the column that identifies projects that will have 100% of their construction expenditures available in the FY 92 and the Augmented FY 92.

Two sets of Staging Ceiling referred to as FY 89 Augmented A and FY 89 Augmented B have been developed from the projects shown on Map 2.3. The one referred to as FY 89 Augmented A in the Staging Ceiling tables reflects the capacity that is expected from one set of projects. The second which is referred to as FY 89 Augmented B in the Staging Ceiling table were computed based on all the projects listed under the FY 89 Augmented A column of Table 2.2.

Transportation projects shown on Map 2.4 and listed in the columns labeled FY 92, FY 93, and FY 94 on Table 2.2 were used to calculate Staging Ceilings if the Revised Test at Subdivision (RTAS) is adopted prior to the adoption of the FY 89 Annual Growth Policy (AGP). These Staging Ceiling are shown as the Revised Test at Subdivision Ceilings for FY 88 in the Staging Ceiling tables.

The Transportation projects shown on Map 2.5 and listed in the columns labeled FY 92, FY 93, FY 94 and FY 95 on Table 2.2 were used to calculate Staging Ceilings assuming the RTAS is adopted in conjunction with the adoption of the FY 89 AGP.

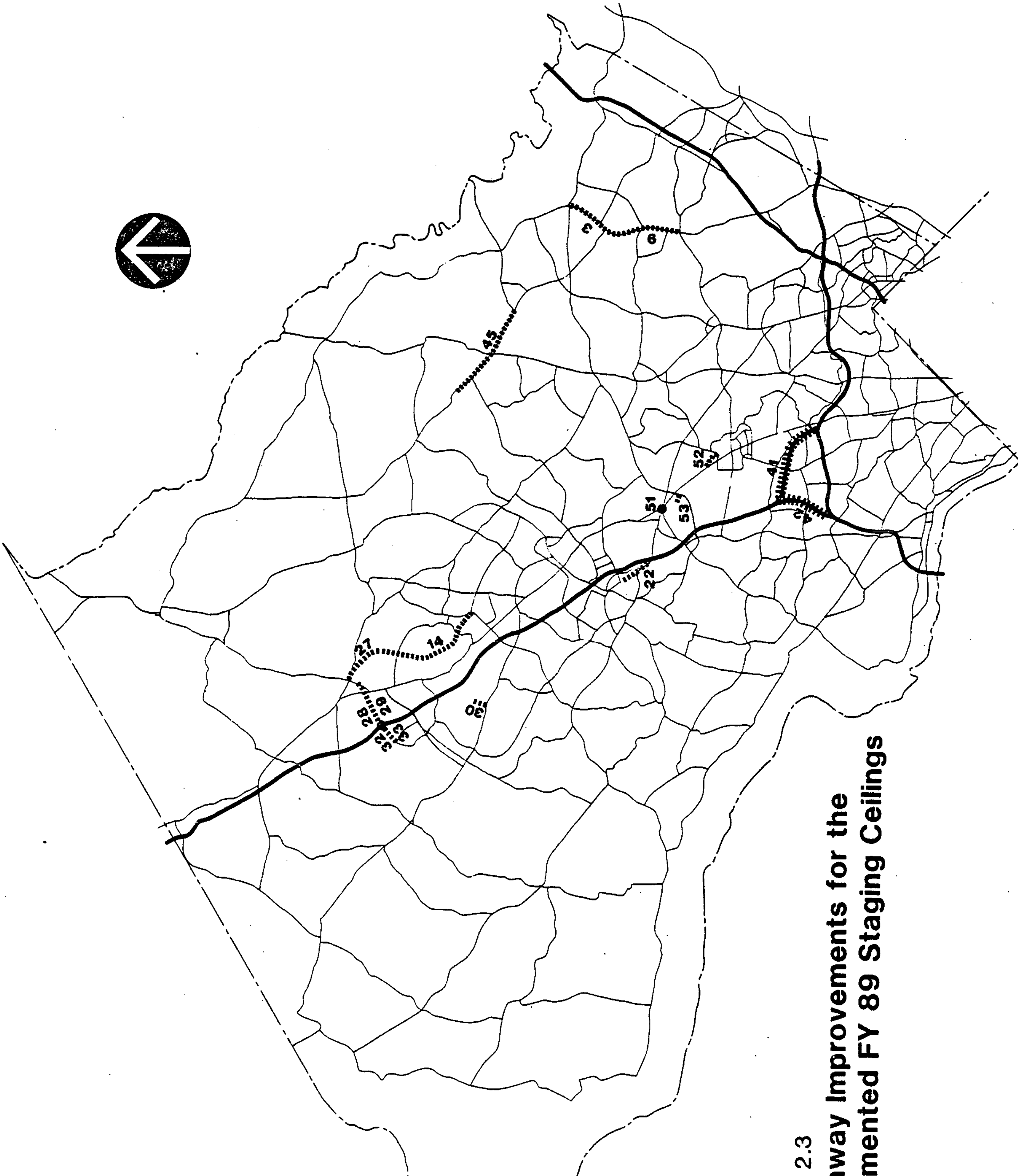
B. <u>TRANSIT CAPITAL IMPROVEMENTS</u>:

Table 2.3 and the associated Map 2.6 present the transit capital projects which have been used in the preparation of the Annual Growth Policy Report. This set of projects are expected to be completed by FY 92, they were therefore used to calculate the FY 89 Staging Ceilings as well as the Augmented FY 89 Staging Ceilings.

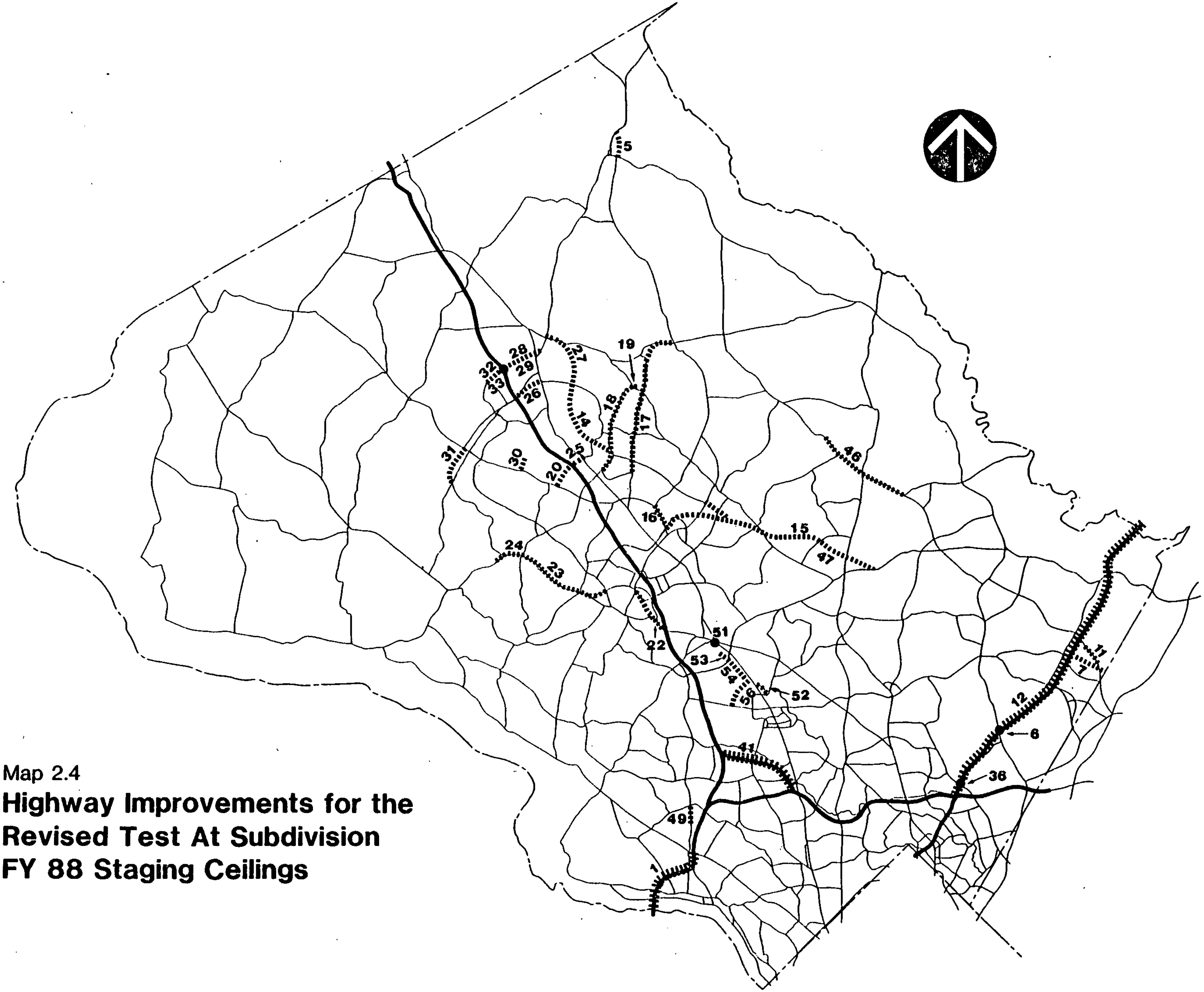
C. <u>RE-EXAMINATION OF MID-TERM ALLEVIATION MEASURES</u>:

This section re-examines the traffic alleviation measures discussed in the staff report, <u>Alternative Transportation Scenarios and Staging Ceilings,</u> prepared October 28, 1986. The list of alleviation measures has been modified to reflect more recent information and analyses.

The County's Growth Policies are intended to maximize both the cost-effectiveness of transportation investments and the quality of urban/suburban living. To meet these goals, future

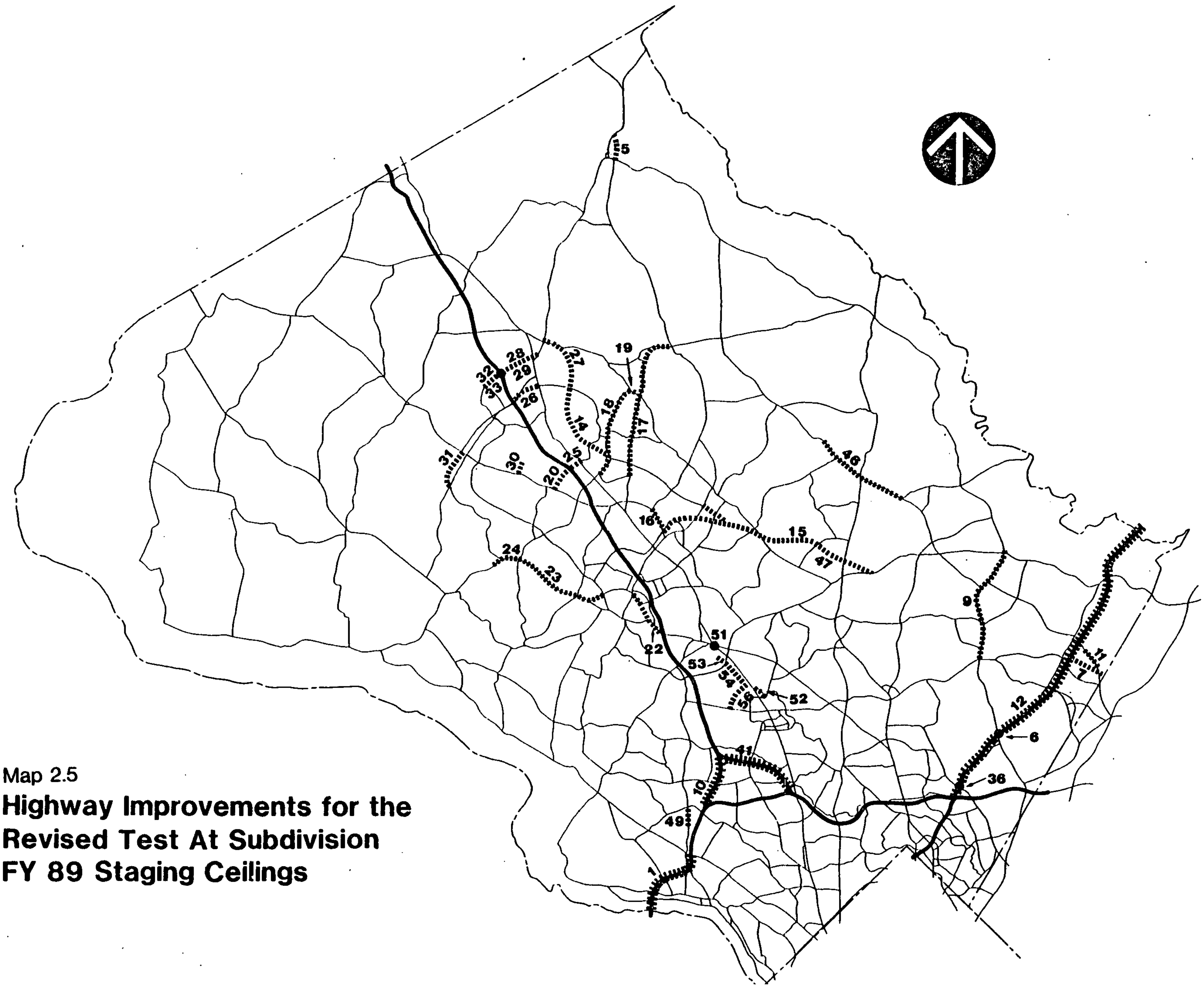


Map 2.3
Highway Improvements for the Augmented FY 89 Staging Ceilings



Map 2.4

Highway Improvements for the Revised Test At Subdivision FY 88 Staging Ceilings



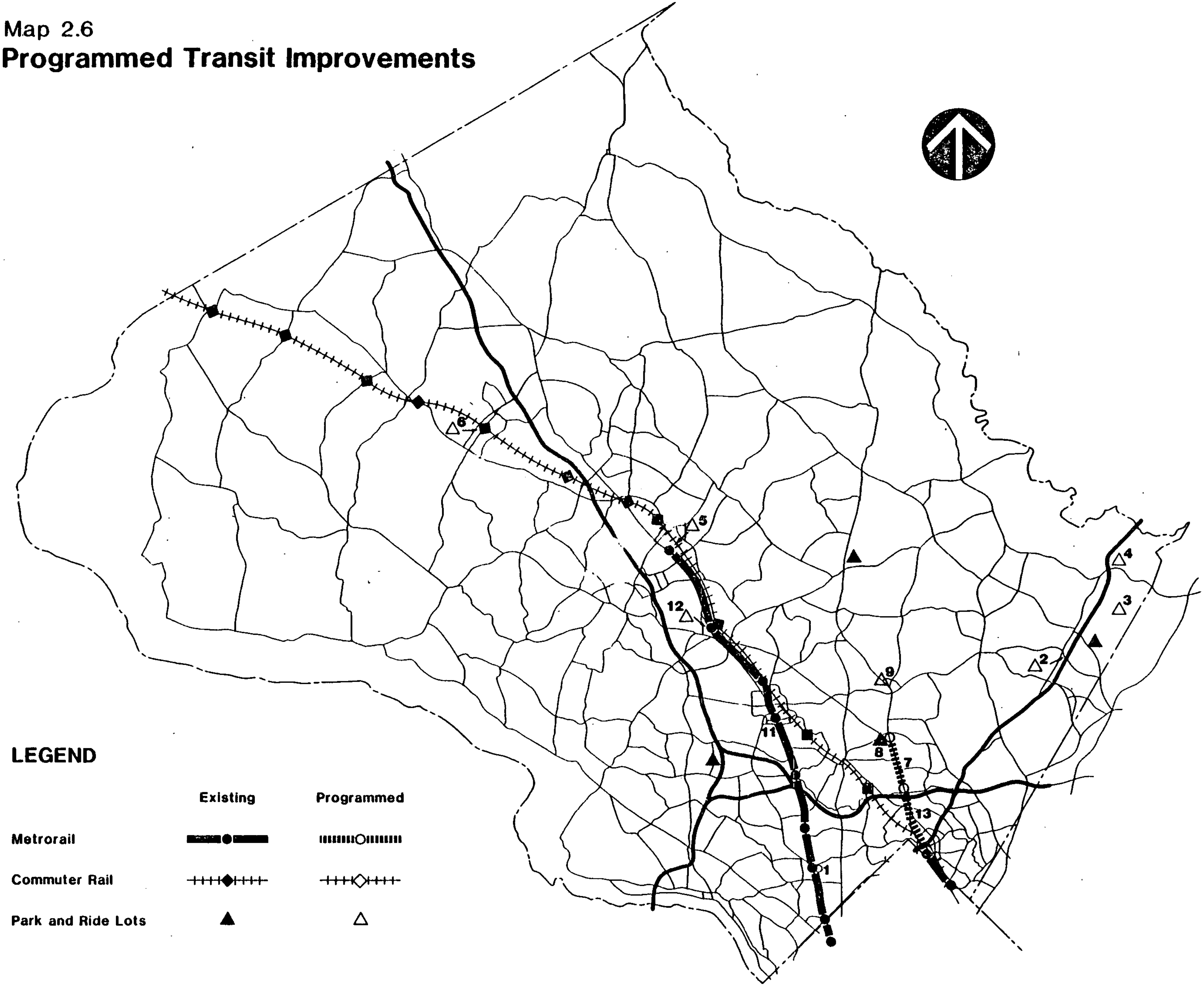
Map 2.5
Highway Improvements for the Revised Test At Subdivision FY 89 Staging Ceilings

TABLE 2.3: LIST OF TRANSIT RELATED PROJECTS BY POLICY AREA WHICH ARE 100% PROGRAMMED FOR CONSTRUCTION IN THE FIRST FOUR YEARS OF THE FY 88-93 CIP, THE MDDOT FY 87-92 CONSOLIDATED PROGRAM, OR WMATA'S CAPITAL BUDGET

Policy Area	PDF No.	Project No.	Map No.	Transit Project and Limits	Scope of Improvement	100% of Const. Expenditures By
BETHESDA	1399A	843176	1.	Bethesda Metro Underpass Wisconsin Avenue (MD 355) at East-West Highway (MD 410)	Pedestrian Underpass	88
FAIRLAND/ WHITE OAK	1399C	783384	2.	Commuter Fringe Parking Lots Seventh Day Adventist Lot	100 Spaces	88
	1399P	883152	3.	Greencastle Lakes Park and Ride Lot Greencastle Road near Columbia Pike (US 29)	150 Spaces	88
	1399Q	883153	4.	Burtonsville Park and Ride Lot Columbia Pike (US 29) northeast of Sandy Spring Road (MD 198)	501 Spaces	88
GAITHERSBURG EAST	1399F	883190	5.	Shady Grove Metro Parking Phase I: Garage at the Shady Grove Metro Station	850 Spaces	89
GERMANTOWN WEST	1399L	763644	6.	Germantown Commuter Rail Station Phase I & II: Germantown Station	138 Spaces	88
KENSINGTON/ WHEATON	1399O	773954	7.	Glenmont Metrorail Line Extension to Wheaton	Wheaton and Forest Glen Stations	90
	1399N	783131	8.	Wheaton Station Enhanced Parking At Wheaton Station	900 Spaces	90
	1399E	873183	9.	Glenmont Park and Ride Lot Phase I: Georgia Avenue (MD 97) at Glenallan Avenue	300 Spaces	88
	1399K	883138	10.	Ride-On Bus Acquisition Expanded Service for Metro Opening	31 Buses	89
NORTH BETHESDA	1365	873190	11.	Metro Station Bicycle Parking Bicycle Parking Garages	Garages at 2 to 4 Stations	91
ROCKVILLE	1399N	783131	12.	Metrorail Add-On Facilities Rockville Station Parking	135 Spaces	88
SILVER SPRING/ TAKOMA PARK	1399O	773954	13.	Glenmont Metrorail Line Extension from Silver Spring to Wheaton	Wheaton and Forest Glen Stations	90

Map 2.6

Programmed Transit Improvements



capital and operating budgets should give greater priority than in the past to measures other than road building. There are substantial opportunities for making more efficient use of the current transportation infrastructure, for improving public and non-motorized transportation, for influencing transportation demand, and making more effective use of advanced information and communications technology.

Traffic alleviation measures could remove peak period vehicle trips from the County's roads by increasing the percentage of travel demand satisfied by transit, carpools, vanpools, bicycles, and walking or by shifting vehicle trips to non-peak times of day. Thus, like a new or widened road, such measures can make possible the accommodation of additional travel demands generated by new development while helping to attain and then maintain the County's policy standards for acceptable traffic congestion levels.

This is analogous to the situation that prevails in the area of electric power generation. Many electric utilities have found it more-cost effective to encourage and subsidize energy conservation measures by electric consumers than it is to provide new and very expensive power generation capacity that will frequently be used only during a small number of peak demand hours each year. Because highway capacity is fully used only during a short time during the peak travel hours of the day, traffic alleviation measures that shift automobile travel demand to other modes during this period and that encourage diversion of trips from this period to less congested hours of the day can substantially increase the efficiency and cost-effectiveness of the transportation system.

The Montgomery County Council and Executive initiated a major new policy direction in October 1986 with the adoption of the Short Term Traffic Alleviation Policy (STTAP), also known as the Interim Growth Policy. The STTAP Report discussed in outline form a number of possible alleviation measures and set forth a conceptual model for the classification and understanding of such measures. This model was also in last year's staff report, <u>Alternative Transportation Scenarios and Staging Ceilings</u>, and is used once again here to frame the discussion of Mid-Term Traffic Alleviation Measures.

1. Reference Framework Model For Alleviation Measures

Figure 2.1 illustrates that there are many factors which influence the phenomenon known collectively as traffic congestion. This model of the factors influencing peak period travel conditions has been constructed to help organize discussion and evaluation of the multiple strategies, policies, programs, and projects that are potential elements in a package of Mid-Term Traffic Alleviation Measures.

This model first divides the universe of factors into three categories: Home Based Factors, Trip Based Factors, and Work

Figure 2.1: Travel Behavior Factors Relating To a Trip From Home To Work

RESIDENTIAL AREA FACTORS

Auto Ownership Factors

o auto availability and ownership, license and operator requirements
o degree of difficulty in obtaining fuel
o social status, prestige, media influence, taxing policies
o family structure
o economic necessity to travel
o physical and mental ability

TRIP BASED FACTORS

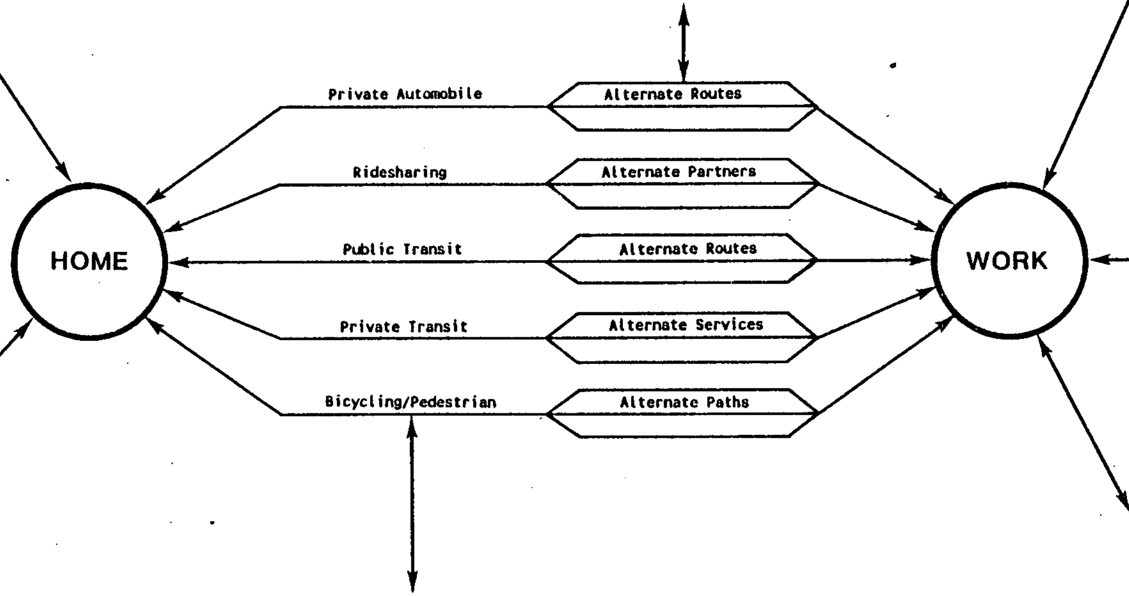
Route Choice Factors

o minimal path in time and/or cost
o imperfect knowledge of options
o capacity constraints and route diversions
o transit route structure, number of transfers, express service
o interpersonal relations and compatibility
o topography; scenic routes

EMPLOYMENT AREA FACTORS

Parking Factors

o availability; type of parking facility
o cost to park; rate system, fee collection method, who pays
o walking distances, vertical climbs
o shelter from adverse weather
o personal safety



Employment Activity Factors

o work hours; fixed or variable
o need for job related travel flexibility
o availability of company autos or shuttle services
o attitude of the company towards the travel needs of employees, visitors, or patrons

Trip Generation and Distribution Factors

o trip purpose; multipurposed?
o what destination, divert to another location?
o does it have to be made now? (flex-time, off-peak travel)
o can the purpose be accomplished without making the trip? (substitute communications)

Mode Choice Factors

o motorized or non-motorized?
o transit availability
  - relative costs, fares, method of payment
  - relative travel speeds, dwell times, transfer times
  - modes of access and egress/intermodal transfers
o availability of secure bicycle parking and showers
o ridesharing opportunities and constraints
o relative safety, comfort, convenience, and reliability
o weather conditions, seasonal variations

Cumulative Site Factors

o density of activity
o pedestrian circulation ease and safety
o proximity to ancillary services such as stores and restaurants
o opportunities for linked trips such as to nearby day care services

Based Factors. This division reflects the most significant facts of the general traffic situation, namely that: (1) it is daily peak period trips that create the congestion, and that (2) the nature of these peak period trips can be influenced by changing either (a) the conditions that affect the origin of the work trip from the home, or (b) the conditions that affect how the traveler arrives at his work destination, or (c) the conditions that affect how the trip is carried out between these two origin-destination points. Within these three basic categories, we can develop further sub-categories. There could be many of these, as Figure 2.1 illustrates. We believe it is useful to concentrate on nine of these, clustered together as follows:

HOME BASED FACTORS

1. Auto Ownership

2. Other Trip Generation (i.e. family structure, neighborhood characteristics, economics, substitute for travel, etc.)

TRIP BASED FACTORS

3. Private Motor Vehicles (mode/route choice)

4. Ride Sharing (mode/route choice)

5. Public and Private Transit (mode/route choice)

6. Bicycle/Pedestrian (mode/route choice)

WORK BASED FACTORS

7. Parking

8. Employment Conditions

9. Cumulative Site Characteristics (i.e. density, other destinations, pedestrian convenience, etc.)

Each of the nine factors mentioned above, contribute to an individual person's decision about how and where he or she makes the trip from home to work and vice versa. Historically, the role of government has been focused primarily on the trip based factors, and further focused primarily on supplying the roads and paths on which the vehicles will travel, and in the case of transit, providing the vehicles and services themselves. In general, the Home Based and Work Based Factors have been considered to be in the realm of the private sector entirely, with the exception of Parking and Cumulative Site Characteristics, which are partially influenced by land use planning and zoning and provision of public facilities.

The result is that the basic driving forces which produce traffic congestion (Home Based and Work Based Factors)

historically have been considered to be inappropriate areas for the exercise of governmental influence. Consequently, government's response to increasing traffic congestion historically has been to increase the capacity of the road network and/or to provide an alternative mode in the form of public transit. In recent years, the concept of spending government dollars to encourage private ridesharing has become accepted also. As time goes on, the challenge of coping with spreading growth and development will also increasingly become the challenge of influencing behavior to reduce the current heavy dependence on private automobiles. Increasing the use of alternative modes and influencing temporal and spatial travel demand characteristics will be needed to increase the efficiency of the transportation system.

This reference model was designed to provide a framework for the evaluation of individual Short-Term and Mid-Term Alleviation Measures. The discussion in this section focuses on a subset of the proposed Mid-Term Alleviation Measures believed to be feasible and cost-effective in the next three to six years. The proposals and recommendations made herein do not exhaust the full range of alleviation measures that should be considered in the long-term.

In adopting the Interim Growth Policy legislation, the County Council requested that the Planning Board include an assessment of Short-Term Traffic Alleviation Measures that could be implemented within a two year time frame, with the understanding that not all of these would be addressed in detail in the Interim Growth Policy.

To implement the STTAP, the County Council in October 1986 appropriated supplemental emergency funds to initiate a number of Short-Term Traffic Alleviation Measures (STTAMs) and indicated intent to make appropriations within the FY 87-88 period to implement several other Council adopted STTAMs. These adopted STTAMs and their status are shown in Table 2.4. These measures were adopted with the understanding that additional measures would be proposed and developed in subsequent Annual Growth Policy Reports, of which this is the second.

The many proposals offered in the STTAP Report are taken as a starting point for the consideration of Mid-Term Traffic Alleviation Measures. To ease the process of evaluating these mid-term measures, the same classification and numbering scheme that was used in the STTAP Report has been used here to categorize traffic alleviation measures.

2. Difficulty of Forecasting Trip Reductions

While it is relatively easy to compute the vehicle-carrying capacity that a new or widened road will offer in advance of construction, it is very difficult to estimate with confidence the number of people who will change their travel behavior as a result of traffic alleviation measures. If, however, there is a

TABLE 2.4: SUMMARY OF TRAFFIC ALLEVIATION MEASURES APPROVED FOR INITIATION IN FY 87-88 AND THEIR BUDGET STATUS

Traffic Alleviation Measure Grouping and Description of the Traffic Alleviation Measures		Short-Term Traffic Alleviation Measures as Approved by County Council	County DOT Budget as Approved by County Council
4.	Ridesharing Measures		
a.	Strengthen staffing of Silver Spring & Bethesda Share-A-Ride Program	X	X
b.	Establish a Share-A-Ride Project in the Gaithersburg East Area	X	
c.	Intensify promotion of Ridesharing advertisement	X	X
e.	Direct subsidy for vanpools	X	X
5.	Public and Private Transit Measures		
b.	Better utilization of Metrorail park and ride through fee increases and ridesharing	X	
c,d m	Increase bus frequency and service coverage; develop operating improvements and tailored services to improve transit convenience	X	X
e.	Provide discounted transit passes through employers	X	X
j.	Provide periodic free transit service to encourage trial usage	X	X
k.	Targeted fare policies to encourage ridership	X	X
l.	Targeted marketing efforts to promote transit use in areas needing traffic congestion alleviation	X	X
n.	Provide new commuter fringe parking lots and use existing private lots	X	X
6.	Bicycle and Pedestrian Measures		
a.	Accelerate Programming of Bicycle/ Pedestrian Projext	X	
c.	Personalized Bicycle/Pedestrian Commuter Demonstration Program	X	
7.	Parking Measures		
d.	Expansion of the "Get In" Program to Bi-County and Board of Education employees working in traffic congestion areas	X	
e.	Consider County legislation requiring private employers to take actions designed to increase the attractiveness of alternative transportation	X	X
8.	Employment Activity Measures		
b.	Employer provided shuttles to Metrorail	X	
	Increased collection of traffic data	X	X

precise definition of the measure and the area in which it will be implemented, it may be possible to develop vehicle trip reduction estimates with some confidence. This is particularly the case if the measure has been implemented in similar circumstances elsewhere and the results of that experience are known. In the absence of either a precise definition of the alleviation measures to be implemented or comparable prior experience in another similar community, all estimates of trip reductions that might be expected from the measures are at best informed guesses.

Many of the alleviation measures proposed here would need to be refined and developed by WMATA, MCDOT, or other organizations to produce specific facilities, projects, plans, laws, or policies. This makes it impossible in many cases to provide anything other than order of magnitude estimates of the potential costs or traffic reductions that would result from implementation of the proposal.

3. Method of Accounting for Traffic Alleviation Measures in Staging Ceilings

Short-Term Traffic Alleviation Measures already adopted and funded by the Council have been specified with a somewhat greater degree of accuracy than the proposed Mid-Term Traffic Alleviation Measures. Estimates of the number of peak period vehicle trip reductions that might be anticipated with implementation of these programmed short-term measures have been made using judgment and comparative experiences and results from other urban areas.

These trip reductions have been compared with the number of new vehicle trips expected as a result of new development in the next two years. By comparing these two quantities of trips, staff has made an estimate of the number of years or months of traffic growth due to employment and household growth by area that could be handled by the effect of the programmed alleviation measures alone over the next two years. This estimate, when compared with the absolute rate of forecasted growth in jobs and households in each area, has yielded an estimate of the potential staging ceiling increment offered by implementation of the funded Short-Term Traffic Alleviation Measures. While this estimate applies to the potential traffic reduction within two years, the actual reduction after four years may be somewhat greater.

It should be made clear that the Mid-Term Traffic Alleviation Measures are not accounted for in the establishment of Staging Ceilings due to the uncertainty concerning their scope and effectiveness. Even after these measures are adopted, there are substantial risks in approving additional subdivisions on the basis of unproven estimates of future trip reductions. A conservative approach would be to increase staging ceilings only after Mid-Term Traffic Alleviation Measures are implemented as demonstration projects and show evidence of sustainable changes in peak hour vehicular trip generation rates, mode choice, and area-wide vehicle miles of travel. With proper evaluation and monitoring, these changes could be used to provide additional

staging ceiling capacity beyond the discounted allowances that might be made (upon full programming of each measure) by the method described above for the currently programmed Short-Term Traffic Alleviation Measures.

Regardless of the timing and method used to increase staging ceilings to account for future alleviation measures, it is important that the County undertake a program of improved transportation system monitoring to assess the effectiveness of alleviation measures in reducing peak hour vehicular trip making. If the County seeks to employ Traffic Alleviation Measures as more than just a marginal adjustment to current staging ceiling constraints, then it will be essential to initiate an annual travel survey of a sample of County households and employers to closely monitor the effect of these Traffic Alleviation Measures. This need is discussed in greater detail elsewhere in this Report.

4. Summary of Proposed Mid-Term Traffic Alleviation Measures

Table 2.5 summarizes the proposed Mid-Term Traffic Alleviation Measures, using the classification model discussed above. In some cases, measures previously identified in the STTAP Report have been divided into more detailed subcategories.

These measures have been roughly classified according to their relative cost, difficulty, and estimated degree of effectiveness in reducing peak period traffic problems, using ratings of Low, Medium, and High for each category. A summary of this classification is shown in Tables 2.6A, B and C. This same classification and evaluation scheme is also used to cluster these measures. Heavy lines are used in these tables to show the numbered clusters that are used for purposes of discussion in the text. The numbering of these clusters proceeds in roughly ascending order of cost and difficulty, focusing on those actions with the greatest effectiveness.

Obviously, some of the measures proposed in this Report as high cost could be implemented to a lesser extent at lesser cost; similarly, measures indicated as offering a high degree of difficulty to attain high effectiveness might be implemented in weaker ways with less effectiveness. The same might apply to lowly rated elements increasing in their ratings along any dimension, possibly with corresponding changes in other dimensions. An attempt has been made in rating these measures to be consistent in the assumptions used to rate any given measure and to apply equivalent standards in judging different measures.

D. SPECIFIC DISCUSSION OF MID-TERM TRAFFIC ALLEVIATION MEASURES:

1. Low-Cost and Easily Implemented Measures

Two alleviation measures classified as low-cost and low-difficulty, offering high or moderate effectiveness (L/L/H and

TABLE 2.5: POTENTIAL MID-TERM TRAFFIC ALLEVIATION MEASURES (3 to 6 Year Implementation Time Frame)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLE-MENTATION	EXPEN-DITURES BY GOV-ERNMENT	ESTIM. EFFECT-IVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
1. Automobile Ownership Measures					
a. Enhanced alternatives to the automobile.					
(i) Auto Rental Cooperatives: Encourage the development of low-cost neighborhood rental car services and automobile cooperatives with a demonstration program in selected areas of the County to encourage lower levels of household automobile ownership.	Medium	High	Low	No	-
b. Impose County auto registration fees or area license.					
(i) (see measure 9c: Area license for Silver Spring and Bethesda CBDs.)					
(ii) Household Auto Ownership Tax. Impose graduated household County auto ownership tax ($20 first car/ $100 second car/ $200 third car per household, for example) with revenues devoted to general transportation improvements.	High	None	Mod.	Yes	-
2. Trip Generation and Distribution Measures					
a. Don't Drive in Rush Hour Marketing. Implement marketing and educational program to lessen vehicular generation rates.	Medium	Low	Low	Yes	-
b. Impose odd/even licensing scheme. (not recommended)	High	Low	High	Yes	-

Government Cost: (Annual)
None= Income Generator
Low= Under $50,000 (net)
Medium= $50,000 - $1 million (net)
High= over $1 million (net)

Difficulty:
Low= Easily Implemented
Medium= Modest political/administrative/social problems possible
High= Substantial possible political/administrative/social problems

Effectiveness:
Low= few peak hour vehicle trip reductions
Medium= Measurable vehicle trip reduction
High= Major traffic reductions

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
c. Develop residential neighborhood street designs favorable to pedestrians, cyclists, and children that hinder but do not bar auto traffic (woonerfs).					
(i) <u>Encourage traffic hindering designs in new residential developments.</u>	Low	Low	Low	Yes	-
(ii) <u>Incorporate traffic hindering designs in existing residential neighborhoods.</u> Particularly for neighborhoods at the edge of congested areas where through traffic is a problem, as part of a comprehensive traffic management strategy. Demonstration project suggested.	High	Medium	Low	Yes	-
d. <u>Trip Length Incentives.</u> Offer incentives to reduce work trip lengths, such as tax or mortgage rate reductions for those living within a short distance of their regular workplace.	Medium	High	Medium	Yes	-
e. <u>Transit Servicability of Neigh.</u> Improve transit servicability of neighborhoods and employment sites.	Medium	Medium	Medium	No	-
3. Private Automobile Measures					
a. <u>Automated Traffic Systems.</u> Increased use of automation in traffic systems.	High	High	Low	Yes	-
b. <u>Clear Blocked Traffic Faster.</u> Establishment of an improved system for expedited clearance of traffic accident scenes, stalled vehicles and obstructions of traffic flow.	Medium	Medium	Low	Yes	-
c. <u>Helicopter Traffic Control/Evac.</u> Installation of helicopter evacuation and traffic control service by the Montgomery County Department of Police.	High	High	Low	Yes	-
d. <u>Road Pricing on Major Roads.</u> Develop road pricing demonstration project using optical scanner technology, targeting key points of congestion (e.g. I-270 and/or Beltway entrance ramps [potential legal problems with federally funded Interstate highways]; entry points to Silver Spring/Bethesda CBDs). Would need further study.	High	High	High	No	-
4. Ridesharing Measures					
a. <u>Improve Sil.Sp./Beth.Share-A-Ride.</u> Strengthen staffing of Silver Spring/Bethesda Share-A-Ride Programs.	Low	Medium	High	Yes	Yes
b. <u>Expand Share-A-Ride.</u> Establish Share-A-Ride Programs in the remainder of County.	Medium	Medium	High	Yes	(Partial)

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
c. Intensify promotion of ridesharing with advertising.	Low	Medium	Medium	Yes	Yes
d. Market state/reg. carpool matching. More effective marketing of regional and statewide carpool and vanpool programs.	Low	Medium	Low	Yes	-
e. Encourage the use of vanpools in County.					
(i) Co. Subsidy For New Vanpools.	Low	Medium	Medium	Yes	Yes
(ii) Co.Subsidy for All Vanpools.	Low	High	Medium	Yes	-
5. Public and Private Transit Measures					
a. Provision of public transportation by the private sector.					
(i) Contract Ride-On service.	Medium	Medium	Low	Yes	-
(ii) Franchise Jitneys/Transit suppl. franchised taxi, van services, or jitneys, particularly for late night and rural services and new higher cost demand responsive services.	Medium	Medium	Medium	Yes	-
(iii) Amend Transportation Regulations. Amend ordinances to open market potential.	Low	Low	Medium	Yes	-
(iv) Dial-a-ride Service. Institute Dial-a-ride services in part or all of County.	High	High	Medium	No	-
(v) Shared-Ride Taxi Service. Institute shared ride taxis to improve taxi service.	Medium	Low	Low.	No	-
b. Improve Metrorail Access/Egress System.				Yes	(Partial)
(i) Adjust Metrorail Parking Fees. Set fee structure at park-and-ride lots to favor ridesharing, bicycle, bus, pedestrian access to Metro.	Low	None	Medium	Yes	(Partial)
(ii) Build More Park-and-Ride Capacity. Increase capacity of automobile park-and-ride lots.	High	High	Medium	No	

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
(iii) Guarded Bike Parking at Metrorail. Provide guarded bicycle parking garages at all 8 Metro stations in Montgomery County to free up spaces in existing park-and-ride lots, to increase Metro use (with bicycle egress) for commuting to suburban employment centers, to increase non-peak direction Metro ridership and transit productivity, and to increase market area of stations without park-and-ride lots. (formerly measure 6d).	Medium	Medium	Medium	Yes	(Partial)
(iv) Market Bike-and-ride Commuting. Agressively promote bicycle access to and from Metro stations and commuter rail and institute minor improvements in station access/parking conditions. (formerly measure 6e).	Low	Medium	Medium	Yes	Yes
(v) Improve Bus-Rail Coordination. Coordinate feeder bus-rail schedules to reduce transfer times.	Medium	Medium	Medium	No	-
c. Selected doubling of bus frequencies. Increase frequency of bus service to boost ridership.	Medium	High	High	Yes	(Partial)
d. Increase bus service coverage. Provide bus services to areas now not served by transit.	Medium	High	Medium	Yes	(Partial)
e. Discount Transit Passes. Provide discounted transit passes through employers.	Medium	Medium	Medium	Yes	Yes
f. Introductory transit vouchers. Free or discounted transit vouchers for new employees and residents.	Low	Low	Medium	Yes	-
g. More Bus Shelters in Cong.Areas. Insure bus shelters exist in congested areas meeting criteria.	Low	Medium	Low	Yes	-
h. Better utilize commuter rail service.				Yes	-
(i). Bike Parking at Commuter Rail. Provide secure bicycle parking at stations.	Low	Low	Low	No	-
(ii) Increase Commuter Rail Service. Increase service frequency and capacity as demand warrants, especially in peak hours.	Medium	Medium	Medium	No	-
(iii) Improve Bus-Rail Coordination. coordinate feeder bus-rail schedules to reduce transfer times.	Low	Low	Low	No	-
(iv) Unify bus-rail fare instruments. develop unified fare system allowing transfers from rail to bus and use of single special transit pass good for Ride-On, Metrobus, and commuter rail.	Medium	Low	Low	No	-

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
i. Improve passenger amenities/convenience.				Yes	-
(i) Sidewalks to All Bus Stops. provide sidewalks and bike paths to bus stops.	Medium	Medium	Medium	No	-
(ii) Improve public information services regarding transit, substituting information technology for the investments that would be required to provide a higher frequency of bus service in low density areas.					
(1) Bus stop Route Maps. Display bus route maps on all bus stop signs.	Low	Low	Low	No	
(2) Real-Time Pass.Info.System. Implement state-of-the-art bus passenger information system demonstration, drawing on technology from Hiratsuka, Japan, GM demonstration in Cincinnati, Ohio, and Toronto, Ontario. Install radios/microprocessors on all buses and information display systems at all bus stop shelters to provide passengers with real-time information on estimated waiting time to the next bus.	Medium	High	High	No	
(3) Improve Phone Info Re.Buses. Combine 5(i)ii(2) with real-time telephone information system, allowing passengers to call ahead to find out when next bus will actually be at their stop.	Medium	High	High	No.	
(iii) Improve schedule availability. Distribute bus schedules at more locations (see also 5i(ii)3).	Low	Low	Low	Yes	-
(iv) Sell Trans.Passes more Places. Increase the number of fare media sales locations.	Medium	Low	Low	Yes	-
(v) Increase bus comfort level.	Medium	Medium	Low.	Yes	-
(vi) Child Daycare at Suburban Transit Centers. Provide spaces for private-contractor-provided child care facilities at or very near Metro stations and transit centers to increase the convenience of dropping children off to daycare while taking transit for households with two working parents, with free park-'n'-ride spaces for parents.	Medium	Low	Medium	Yes	-
(vii) Bike Racks on Selected Buses. Install bicycle racks on buses on selected routes.	Low	Low	Low	Yes	-
(viii) Bike Racks at Selected Bus Stops. provide bicycle racks at selected bus stops.	Low	Low	Low	No	-

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
(ix) Convenience Grocery, Pharmacy, and service shops at Suburban Transit Centers and Park-'n'-Ride Lots. Provide convenience stores near Metro stations so that transit users could perform errands to and from work without needing car.	Medium	None	Medium	No	-
j. Free Transit Promotions. Provide periodic free transit service or passes to encourage trial usage.	Medium	Low	High	Yes	Yes
k. Targeted Fare Policies. Target fare policies to encourage ridership.	Medium	Medium	High	Yes	Yes
l. Targeted Marketing. Targeted marketing efforts to promote transit use in congested areas.	Medium	Medium	Medium	Yes	Yes
m. Provide operational improvements and tailored services to enhance transit convenience and travel times and schedule adherence.				Yes	(Partial)
(i) Reserved Transit Right-of-Way. Provide reserved express bus lanes, light rail, trolley bus, or dual - mode transit in selected highway corridors (e.g. I-270, Beltway, Georgia Avenue, Colesville Avenue, and New Hampshire Avenue, University/Randolph/355/Viers Mill) as foundation for dedicated transit network.	High	High	High	No	
(ii) Signal Preemption for Buses. Bus Preferential Treatment at congested intersections through on-board bus-radio-actuated signal preemption system.	Medium	High	High	No	
(iii) Bus Queue Jumper Lanes. Preferential Treatment at congested intersections and bottlenecks through installation of queue-jumper lanes at selected locations.	High	High	Medium	No	
(iv) Transit Centers With Pulse Service. Develop multi-modal transit centers with pulse service (i.e. all bus routes serving center arrive and depart at matching times, with 5 minute layovers, to facilitate short and predictable transfer waiting times for improved intra-suburban connections), as in Portland, Oregon and Philadelphia's northern suburbs.	Medium	High	High	No	
(v) New Express Bus Services	Medium	Medium	High	Yes	Yes
n. Commuter Fringe Parking. Provide commuter fringe parking lots in conjunction with existing or new express transit services using public or private property.	High	High	Medium	Yes	(Partial)

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
6. Bicycle and Pedestrian Measures					
a. Accelerate Bike/Ped Facil.Dev. Accelerate construction of programmed bicycle and pedestrian capital projects, compressing 6 years of funding into next 2 years. Hire bikeway design consultant to identify future projects and design near-term facility improvements.	Low	Medium	Medium	Yes	Yes
b. Ensure that development and road construction provides bicycle and pedestrian facilities.					
(i) Increase Bike/Ped Facilities. Dramatically expand the provision of sidewalks and bike paths separated from traffic throughout the urban/suburban parts of the County to improve conditions for non-motorized travel. Increase funding for bicycle/pedestrian facilities to 10% of transportation capital budget to meet facilities backlog.	Medium	High	High	No	
(ii) Build Sidewalks with Road Projects. Minimize the use of exemptions to the County law that requires provision of sidewalks and bikepaths along all County road construction projects by providing such facilities if at all possible.	Low	Medium	Low	Yes	
c. Personalized Bike/Ped.Commute Demo. Develop Personalized Bicycle and Pedestrian Commuting Demonstration Program to encourage non-motorized commuting.	Low	Medium	Medium	Yes	Yes
d. Provide guarded bicycle parking at Metro Stations [See 5b(iii)].					
e. Promote existing Metrorail bike parking [see 5b(iv)].					
f. Bike/Pedestrian Planning Effort. Devote several staff positions in County agencies to the planning, facility design, and marketing for non-motorized modes of transportation.	Low	Medium	Medium	Yes	-
7. Parking Measures					
a. County Employee Parking Fee. Imposition of parking fees for County, Bi-County, and Board of Education employees in County office building garages or lots in traffic congested areas.	Medium	None	Low	Yes	-

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLE-MENTATION	EXPEN-DITURES BY GOV-ERNMENT	ESTIM. EFFECT-IVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
b. Increased and rationalized fees in private and public parking lots, garages, and street meters.					
(i) <u>High Daily Parking Fees.</u> Impose major increases in parking charges at public garages for all day parking, with low short term shopper rates for those entering the garages after 10 am.	Medium	None	High	Yes	-
(ii) <u>Peak Hour Entrance or Exit Surcharge.</u> Impose substantial parking surcharge for drivers entering public garages with their cars between 7 and 9:30 am or exiting between 4 and 6:30 PM.	Low	None	High	No	
(iii) <u>Parking Tax on Private Parking.</u> Impose substantial parking tax on private garages in congested areas with revenue for general transportation improvements.	Medium	None	High	Yes	
(iv) <u>HOV Parking Set-asides.</u> Set aside certain central area parking garages for exclusive use by carpools or vanpools between 7 and 10 am in Silver Spring and Bethesda.	Medium	Low	High	No	
c. <u>Restrict Parking Supply.</u> Place tighter limits or ceilings on public parking supply in Parking Lot District Areas.	High	None	High	Yes	-
d. <u>Expansion of "Get-In" Program.</u> Expand Get-In Program to Bi-County and Board of Education employees working in traffic congested areas.	Medium	Low	Low	Yes	Yes
e. Consider County legislation requiring private employers to take actions designed to increase the attractiveness of alternative transportation.					
(i) <u>Equalization of Commuter Subsidies.</u> Adopt legislation requiring equalization of employer commuter subsidies (all employers providing free parking must provide an equivalent subsidy to employees who get to work by means other than the private single passenger automobile.	High	Medium	High	Yes	(Study)

(see also 8e: TSM Ordinance)

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES	DIFFICULTY OF IMPLE-MENTATION	EXPEN-DITURES BY GOV-ERNMENT	ESTIM. EFFECT-IVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
8. Employment Activity Measures					
a. <u>Neg./Fin.Incent.Staggered Work Hrs.</u> Intensify negotiations and provide County financial incentives for existing large employers in the County to arrange flextime or staggered work hours.	High	High	High	Yes	-
b. <u>Employer Metrorail shuttles.</u> Encourage employers to provide shuttle bus or van services to Metrorail stations.	High	Low	Medium	Yes	Yes
c. Provide County financial incentives for employer provided vanpools. [See 4e(i) and 4e(ii)].					
d. <u>Foster Transport.Management Assns.</u> Foster development of Transportation Management Associations in high growth areas to obtain employer cooperation in workplace trip reduction programs.	Medium	Medium	Medium	No	
e. <u>Enact TSM Ordinance w/Enforcement.</u> Adopt TSM ordinance a la Pleasanton, CA / Seattle, WA requiring employers to establish workplace peak hour trip reduction programs.	Medium	High	High	No	
f. <u>Trip Reduction Banking Program.</u> Establish trip reduction banking program with marketable credits to encourage trip reduction programs among current employers.	High	Medium	Low	No	
9. Other Employment Area Measures					
a. <u>Traffic Cell System Sil.Sp./Beth.</u> Establish traffic cell system in central areas of Silver Spring, Bethesda, and/or Rockville CBD's to bar through movements by single passenger automobiles across the traffic cell boundaries, while facilitating intraurban movements by transit, bicycles, and pedestrians. Autos would be routed onto ring roads that bypass the town centers.	High	High	High	Yes	
b. <u>Auto Restricted Zone Sil.Sp./Beth.</u> Create pedestrian-transit streets in Silver Spring and Bethesda CBD's.	High	High	High	Yes	-
c. <u>Area Licensing-Silv.Sp./Beth.</u>.(formerly mentioned in STTAMR under 1.b.) Impose area licensing fee for Silver Spring and Bethesda Central Business Districts for single passenger automobiles from 7 to 10 am, providing diversion routes around CBDs for through traffic, with improved	High	Medium	High	No	

Table 2.5 (continued)

PROPOSED TRAFFIC ALLEVIATION MEASURES		DIFFICULTY OF IMPLEMENTATION	EXPENDITURES BY GOVERNMENT	ESTIM. EFFECTIVENESS	PROPOSED IN IGP REPORT	ADOPTED BY COUNCIL
	transit services (such as a free and frequent CBD loop shuttle bus serving parking garages at periphery and employment centers in core) and better bicycle and pedestrian conditions.					
d.	E-W Transitway Silv.Sp./Beth. Light rail/trolley bus/dual-mode connector between Silver Spring and Bethesda.	High	High	High	No	
e.	Pk.Hr.Auto Occup.Restrict.Silv.Spr./Beth. Limit peak period traffic on selected streets to carpools, buses, and bicycles in am or pm peak periods.	High	Medium	High	No	

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TABLE 2.6 A: LOW COST TRAFFIC ALLEVIATION MEASURES

EFFECTIVENESS IN ALLEVIATING CONGESTION	HIGH	MEDIUM	LOW
HIGH	2b: Odd-Even License 7c: Restrict parking supply **5A**	7b(i): Hi daily parking fees 7b(iii): Parking tax on private parking 7b(iv): HOV parking set asides **2**	** 5j: Free transit promotions 7b(ii): Peak period surcharge @ garages **1**
MEDIUM	1b(ii): Household auto ownership tax * 8b: Employer Metrorail shuttles	5i(ix): Shops near Metro and Park & Ride	5a(iii): Amend transport.regulations * 5b(i): Adjust Metrorail parking fees 5f: Introductory transit vouchers
LOW		2a: Don't drive in rush hr. marketing 5a(v): Shared ride taxi service 5h(iv): Unify bus-rail fare instruments 5i(iv): Sell trans.passes more places 7a: County employee parking fee * 7d: Expansion of Get-In Program	2c(i): Encour.traf.tranquil in new devel 5h(i): Bike parking at Commuter rail 5h(iii): Improve bus-rail coordination 5i(ii)1: Bus stop route maps @ all stops 5i(iii): Improve bus sched.availability 5i(vii): Bike racks on selected buses 5i(viii): Bike racks@ selected bus stops

RELATIVE DIFFICULTY OF IMPLEMENTATION

* = Measure approved by Montgomery County Council (in whole or part)

** = Measure programmed in County Budget (in whole or part)

TABLE 2.6 B: MODERATE COST TRAFFIC ALLEVIATION MEASURES

RELATIVE EFFECTIVENESS IN ALLEVIATING CONGESTION			
HIGH	* 7e(i): Equalization of commuter subsidy 9c: HOV Area w/except.permit-Sil.Sp./Bet **5B**	* 4b: Expand Share-A-Ride ** 5m(v): New express bus services ** 5k: Targeted fare policies **3**	** 4a: Inc.Sil.Sp./Beth.Share-A-Ride
MEDIUM	8g: Trip reduction banking program 5m(iii): Bus queue jumper lanes	2e: Improve neigh.transit servicability 5a(ii): Franchise jitneys/transit suppl. ** 5b(iii): Guarded bike pkg.@ Metro/rail 5b(v): Improve bus-Metrorail coordinat. * 5d: Increase bus service coverage ** 5e: Discount transit passes 5h(ii): Increase commuter rail service 5i(i): Sidewalks to all bus stops 5i(vi): Child daycare at transit centers * 5l: Targeted marketing efforts 8c: Foster Transport.Management Assns.	** 4c: Intensify Promotion of Ridesharing ** 4e(i): Co.subsidies for new vanpools ** 5b(iv): Market bike & ride commuting * 6a: Accelerate bike/ped.facil.develop. * 6c: Personalized Bike/Ped.Commute Demo. 6f: Bike/Pedestrian planning effort **4**
LOW	2c(ii): Traf.tranquil.in comp.traf.mgt. 8f: Trip reduction banking program	1a(i): Auto rental cooperatives 3b: Clear blocked traffic faster 5a(i): Contract Ride-On service 5i(v): Improve bus comfort level	4d: Market state/reg. carpool matching 5g: More bus shelters in cong.areas 6b(ii): Ensure more sidewalks
	HIGH	MEDIUM	LOW

RELATIVE DIFFICULTY OF IMPLEMENTATION

* = Measure approved by Montgomery County Council (in whole or part)

** = Measure programmed in County Budget (in whole or part)

TABLE 2.6 C: HIGH COST TRAFFIC ALLEVIATION MEASURES

RELATIVE EFFECTIVENESS IN ALLEVIATING CONGESTION	RELATIVE DIFFICULTY OF IMPLEMENTATION: HIGH	MEDIUM	LOW
HIGH	3d: Road pricing on major roads 5m(i): Reserved transit Rights-of-Way 8a: Neg./fin.incent.-staggered work hrs. 9a: Traffic Cell System Sil.Sp./Beth. 9b: Auto restricted zone Sil.Sp./Beth. 9d: E-W transitway Silv.Sp.-Beth. 9e: Peak Period HOV Restrict.Sil.Sp./Bet. **7**	* 5c: Double bus Frequency 5i(ii)2: Real time pass.info system 5i(ii)3: Improve phone info re.buses 5m(ii): Signal preemption for buses 5m(iv): Transit centers w/pulse service 6b(i): Major expans.of bike/ped. facil. 8(e): Enact TSM Ordinance w/enforcement **6**	
MEDIUM	5a(iv): Dial-a-Ride service 5b(ii): More Park & Ride spaces @ Metro 5n: Build more commuter fringe parking	2d: Trip length incentives	4e(ii): Co.subsidies for all vanpools
LOW	3c: Helicopter traffic control/evac. 3a: Automated traffic systems		

* = Measure approved by Montgomery County Council (in whole or part)
** = Measure programmed in County Budget (in whole or part)

L/L/M) have already been adopted by the Council through the STTAP. These are free transit promotions (measure 5j) and adjustments to Metrorail parking fees (measure 5b(i)). Two additional measures in the category of L/L/M deserve serious consideration. These are the use of introductory transit vouchers (measure 5f) and the amendment of ordinances and regulations to open the market to private transportation providers, particularly for peak period supplemental services (measure 5a(iii)). Both of these measures involve considerable uncertainty in their likely effect on peak period vehicular travel demand, but might after several years of operation account for moderate reductions equivalent to several months of household and employment growth at current rates.

Metrorail parking fees (Measure 5b[i]) are set by the Washington Metropolitan Area Transit Authority (WMATA) but reflect local jurisdictional policy to the extent that there is not a conflict with other regional objectives. Recently suburban jurisdictions have endeavored to increase Metrorail parking fees while lowering bus fares to encourage a shift in mode-of-access to stations. These are thus far demonstration programs which have proven the effectiveness of pricing in shifting mode choices. This demonstration program approach may be made permanent and expanded to more stations in the future. However, before this is accomplished some regional issues need to be settled concerning the distribution and use of increased parking revenues. In particular, the County DOT is interested in both expanding parking facilities and cross-subsidizing feeder bus services with the aid of Metrorail parking revenues.

Introductory transit vouchers (Measure 5f) are intended to encourage new County residents and employees to try using public transportation during the initial few months after their move, when their commuting and travel habits are not yet firmly established. During this period, the availability of a free or heavily-discounted transit pass good on Ride-On, Metrobus, and Metrorail can encourage experimentation with the public transportation system. Unless such trial use occurs in the initial months, it is far less likely that the new resident or worker will try or change to transit for their work commute. The cost of providing introductory transit vouchers County-wide might be offset by combining these vouchers with other advertising promotions geared to the new worker or resident.

Amending ordinances and regulations to open the market to private transportation providers (Measure 5a[iii]) would require some additional study, but offers the potential for the evolution of new specialized transportation services provided by the private sector to supplement the public transportation system. Peak period supplemental services tailored to specific market segments, perhaps operated at a higher fare than the public system, could likely attract some drivers out of their automobiles who feel that their needs are not addressed by current transit services. Paratransit, offering semi-flexible routes or demand-responsive services, comparable to jitney

or shared-ride taxis, not now provided in Montgomery County, could meet the needs of many people who do not now use transit at all. It might be necessary in the longer term to adjust or revise public transit routings or to impose conditions on where, when, and how these private providers could compete with existing public transportation service to protect the public interest.

There are a number of low-cost, low-difficulty, low effectiveness (L/L/L) measures not yet implemented. Individually these may offer little effectiveness in alleviating congestion but together they could constitute measurable, if modest, progress in reducing peak period traffic and thus deserve serious consideration by the County. These actions are as follows:

- 2c(i): Encourage Traffic Hindrance Street Designs in New Developments.
- 5h(i): Bike Parking at Commuter Rail Stations.
- 5h(iii): Improve Bus-Rail Coordination at Commuter Rail Stations.
- 5i(ii)1: Provide Bus Route Maps at all Bus Stops.
- 5i(iii): Improve Bus Schedule Availability.
- 5i(vii): Bike Racks on Selected Buses.
- 5i(viii): Bike Parking Racks at Selected Bus Stops.

2. Low Cost and Moderately Difficult Measures Offering High Effectiveness in Reducing Congestion

A second cluster of alleviation measures deserving serious consideration by the County are actions classed as "L/M/H," offering low cost and only moderate difficulty in implementation with the promise of being highly effective in reducing congestion. All of these measures would in one way or another affect the availability of free or subsidized automobile parking which strongly encourages commuters to drive their own cars to work during peak hours. These include the following:

- 7b(i): High daily parking fees.
- 7b(iii): Parking tax on private parking.
- 7b(iv): Setting Aside Selected Central Area Parking Garages for High Occupancy Vehicles (HOVs).

Free parking is one of the most important factors influencing conditions of suburban traffic congestion, not only in Montgomery County, but across the United States. Unless users pay the real costs of their peak period automobile use, they will

continue to use the subsidized single-passenger automobile in numbers greater than free market conditions would provide, requiring higher public and private transportation expenditures than if the various transportation modes competed on an equal basis.

The measures in this cluster could individually have a significant impact on peak period vehicular travel demand. In combination with one another, the impact on staging ceilings could be substantial.

Parking Fee Increases. (Measure 7b[i]) Substantial public parking fee increases and carpool/vanpool parking set-asides would be primarily applicable to and offer the greatest reductions in peak hour vehicle trips in the down-County employment centers of Silver Spring and Bethesda.

While the cost of public parking is politically sensitive, it is one of the most important determinants of mode choice in areas like Silver Spring, where the vast majority of the parking supply is under public control. Although parking rates have been increased recently, further increases in the daily parking rates to at least twice the current level may be necessary to induce greater use of transit and ridesharing by workers employed in the down-County employment centers. Applying the rate increases to commuters who arrive or leave during the peak traffic hours through peak period surcharges (measure 7b[ii]), may help persuade commuters to shift their work hours to non-peak periods. Without such measures, traffic problems threaten to limit the potential for further economic development. In any case, it is important to facilitate parking for shoppers and mid-day business travelers by keeping short-term parking rates and mid-day rates inexpensive. Parking cost measures should be an integral part of any traffic alleviation strategies for Transportation Management Districts in the County.

HOV Set-Asides at Parking Garages. (Measure 7b[iv]) The parking garages nearest to the downtown centers of both Silver Spring and Bethesda might permit only carpools to enter between 7 and 10 am each workday, lifting the restriction during the day to facilitate shopping and business travel. This could measurably raise the occupancy of automobiles entering the central area in the morning peak hour. If combined with an HOV Area with exemption permits (measure 9c), peak period surcharges (measure 7b(ii)), or strict central area HOV restrictions (measure 9e) and other measures, the effect on auto occupancy rates could be quite substantial, possibly providing as much as several years worth of staging capacity in the down-County employment centers.

Private Parking Tax. (Measure 7b[iii]) A tax on private parking could be imposed in several ways and might apply only to down-County CBD areas or County-wide. The intent would be to raise the cost of private parking to induce drivers to consider other ways means of commuting. It would be desirable for such a

tax to weigh heavily on all day parking while having little effect on short-term mid-day parking.

3. Measures of Moderate Cost and Difficulty Offering High Effectiveness

Several important traffic alleviation measures already adopted in the STTAP fall into this category of moderate cost and low to moderate difficulty with high effectiveness, including the provision of increased express bus services, targeted transit fare policies, and expansion of the Share-A-Ride program. In addition, this category includes a more comprehensive measure, the enactment of a TSM ordinance with provisions for enforcement.

Share-A-Ride Expansion. (Measure 4b) One of the most cost-effective alleviation measures is to strengthen and expand the Share-A-Ride Program in various areas of the County. Share-A-Ride's personalized matching service has proven to be very successful in influencing commuters to start using carpools, vanpools, and public transportation. It has also served as a decentralized information center for other public and private sector ride-sharing incentives in the area.

Sponsored initially by the M-NCPPC, Share-A-Ride began as a demonstration program in Silver Spring in 1979. The program tested the effectiveness of personalized techniques in persuading commuters to share rides. Due to the program's high success rates in Silver Spring, the MCDOT has assumed responsibility for continuing the program in Silver Spring and expanding it to Bethesda.

Although the STTAP provided for an increase in the staff of the Silver Spring and Bethesda Share-A-Ride Programs and the initiation of a Share-A-Ride program in the Gaithersburg East area, there is substantial room for expansion of the Share-A-Ride personalized ridesharing services in other areas. To attain maximum benefit from this very cost-effective strategy, the County could establish a goal of creating in each policy area of the County a Share-A-Ride Program that would offer work-end as well as home-end marketing services.

4. Measures of Moderate Cost, Difficulty, and Effectiveness

The majority of short-term traffic alleviation measures adopted thus far in whole or in part by the Council have been in this category of moderate cost, low to moderate difficulty, and moderate effectiveness. These include increased bus service coverage, provision of guarded bicycle parking at Metrorail stations and the marketing of bike-and-ride travel, discounted transit passes sold by employers, temporary subsidies for newly formed vanpools, targeted transit marketing, intensified promotion of ridesharing (measure 4c), and accelerated programming of

bicycle and pedestrian facilities (measure 6a). In addition, this category includes:

- 2e: Improved transit servicability of neighborhoods and employment sites.
- 5a(ii): Franchising of jitneys and transit supplements.
- 5b(v): Improved bus-Metrorail coordination.
- 5h(ii): Increased commuter rail service.
- 5i(i): Provision of sidewalks to all bus stops.
- 6f: Improved bicycle/pedestrian planning.
- 8c: Fostering Transportation Management Associations.

Several of these measures are focused on reducing the problems people now encounter when transferring between different modes of public or non-motorized transportation. This is an area of great opportunity for highly cost-effective government action. One of the major differences between public transportation in the United States and Europe or Japan is in the degree to which transfers between modes are coordinated and facilitated. Research suggests that this an important factor that helps account for the greater use and lower costs of public transportation in Japan and Europe relative to the United States.

Travel time is one of the most important factors influencing people's choice of travel modes. Research has shown that travel time spent in motion traveling to one's destination is resented by travelers far less than travel time spent waiting for transit. Reflecting this fact, transportation mode choice models multiply the time spent waiting for transit or transferring from bus-to-bus or between bus and rail by a factor of 2 to 3 and add this to the transit travel time when comparing the relative automobile vs. transit travel time difference.

This has far reaching implications for the evaluation of how cost effective different alleviation measures may be in diverting automobile drivers to transit. It means that a five minute reduction in the waiting time or transfer time experienced by transit riders can induce as many auto drivers to change to transit as reducing the in-vehicle transit travel time by ten or fifteen minutes.

Targeted Marketing. (Measure 5[l]) The County has been pursuing a program of targeted marketing to increase ridership in selected markets. Although it is sometimes difficult to isolate the effects of a single or combined campaigns, the indications are that ridership increases have resulted from these efforts. The all-day ("jingle bus") transfer increased ridership about 10% and has been made a permanent feature of the fare structure since its successful trial last year. Free transit pass offers through

local news media appears to net a high pay back with about 30% of the respondents continuing to use transit at least occasionally. Overall ridership is up 17% over levels a year ago. The Transportation Department plans to continue their targeted marketing campaigns with emphasis on instilling a good transit image in grade schoolers and in the ranks of commuters who don't normally identify themselves in the category of "bus users." Marketing efforts will also include making more bus information available at rail stations and other time table distribution points.

Improved Bus-Metrorail Coordination. (Measure 5b[v]) One of the most productive improvements that could be made to public transportation in Montgomery would be to improve the schedule coordination of bus and rail services. There are few things more frustrating to transit riders than to get off one transit vehicle with hopes of transferring to another transit vehicle, only to see that vehicle pulling out of the station, leaving the hapless passenger to wait in frustration for as long as 30 minutes, contemplating how much less trouble it would be to drive a car to make his or her trip. This problem can be minimized by formally coordinating feeder bus and rail schedules.

The bus route planning and scheduling in Montgomery County has been sensitive to this need, but opportunities for enhanced coordination still remain. Transit ridership can be maximized by scheduling feeder buses to arrive at rail stations within several minutes of trains and to depart from stations only after disembarking rail passengers have had time to walk to the bus loading point. Use of improved communications technology might make it possible to let feeder bus drivers know if a Metro train their bus is meeting is running a couple of minutes behind schedule. With such information in the hands of drivers or bus dispatchers, a policy might be adopted in at least some cases to hold buses at the station for up to several minutes past the normal scheduled departure as an aid to transferring passengers.

This strategy could be further enhanced by adopting and marketing joint bus-metrorail fare instruments (measure 5h(iv)) and publishing bus schedules that cross reference rail schedules, letting passengers and potential passengers know that these connections can be expected to be routine and hassle free. The introduction of transit centers with pulse service (measure 5m(iv), discussed below) would further complement this approach of integrating transit modes and minimizing transfer delays.

It appears that in at least some cases it would be more cost-effective in terms of diverting auto drivers to transit to adopt such improved coordination and service integration than it would be to increase average bus speeds through provision of express buses and priority treatments, such as reserved bus lanes. Nonetheless, measures that would speed transit vehicles and increase schedule adherence can only further improve the attractiveness and performance of the County's transit system and each proposal needs to be evaluated on its own merits.

Guarded Bicycle Parking at Metrorail Stations and Marketing of Bike-and-Ride Travel. (Measure 5b[iii]) Improving bicycle access to express transit services is another highly cost-effective strategy for diverting automobile drivers from peak period automobile use by expanding the market area of transit. Research in America has shown that people are willing to spend twice as long a time bicycling to an express transit stop than they are willing to walk, presumably because of the greater travel speed of a bicycle. The greater user control over bicycle access journeys means that bike-and-ride travelers usually have shorter waiting times going to and from Metro than those using feeder buses for access.

Problems of poor access route conditions, parking facilities that are hard to use or insecure from vandalism, and the lack of marketing of the concept help account for the current low level of bicycle use for Metro access. In comparable fast-growing automobile-dominated suburban areas of northwestern Europe and Japan, where secure bicycle parking is widely available, the bicycle is the predominant mode of access to express transit.

Secure bicycle parking can be provided at transit stations at one-tenth to one-hundredth the capital and operating cost of an automobile park-and-ride space and can be provided where there is no acceptable site for automobile parking. While park-and-ride lots improve access to transit only at the home-end, bike-and-ride with secure overnight parking can serve both home-end and work-end transit access, making it possible for workers to cycle from the station to employment centers one-quarter to two miles from Metro that are otherwise inaccessible by transit.

With all park-and-ride lots on the Red Line often full to capacity, the County Council in 1986 appropriated $250,000 to demonstrate in Montgomery County the concept of guarded Metrorail station bicycle parking and to enhance bicycle access and egress to and from Metrorail at four stations. MCDOT has awarded a contract with the Bicycle Federation to study possible options. In the meantime, there are opportunities to make short-term improvements in the administration of the current bicycle access to Metro program. Immediate actions that could be taken include the reduction of bicycle locker fees (now $25 for a minimum 3-month rental), the institution of weekly or even daily bicycle locker rentals (if possible, available from Metro station agents or other on-site personnel), and the marketing of existing bicycle parking at stations.

Increased Bus Service Coverage. (Measure 5d) In adopting the STTAP, the County Council approved funds to increase bus service coverage into several areas not previously served by transit. Further study is needed to identify origin-destination pairs with sufficient peak period travel demand to justify new or improved bus service.

Franchising of Jitneys and Transit Supplements. (Measure 5a[ii]) An alternative to expanding public transportation service, particularly in lower density areas, is the franchising of jitneys, shared-ride taxi services, and other forms of privately provided supplemental transit services. As discussed above, these can frequently fill niches in the market for transportation services that are too small or specialized for a larger public transit agency to recognize and economically fill. By stratifying the market into more segments, services can be more closely tailored to the needs of potential users and can tap ridership that otherwise would not use public transportation. Indeed, one of the market niches for such specialized transportation providers is in subscription or demand-responsive feeder services to and from Metro.

Increased Commuter Rail Service. (Measure 5h[ii]) With improved coordination between bus and rail services and increasing employment in the Gaithersburg, Rockville, and Silver Spring areas, there may be opportunities to increase the role played by the MARC (Maryland Rail Commuter) service provided on the Brunswick Line by the State Railroad Administration (SRA). The State provides the equipment which is operated under contract by CSX Transportation. The service has been expanded in recent years and ridership is up about 10% per year in the last three years. As a result of recent studies, SRA is planning to: 1) continue the station parking expansion program in growing areas, such as Germantown; 2) open new stations where there is optimum bus and highway accessibility such as their recent inauguration of service at Metropolitan Grove; and 3) continue upgrading equipment and passenger capacity as indicated in their Passenger Services Program. This last program will add cars and install a centralized traffic control system on the Brunswick Line.

Provision of Sidewalks to All Bus Stops. (Measure 5i[i]) Ensuring that most potential bus riders can safely and comfortably access bus stops as pedestrians from all nearby residences and activity centers is essential if people are to view the use of public transportation as something other than a means of last resort. The lack of sidewalks along many busy roads in the County served by buses is a significant factor inhibiting the use of public transportation by those who have a choice of other modes. It will take some years at a substantially increased level of annual capital funding to improve the quality of the pedestrian environment in the County, for the infrastructure needs are substantial. In setting priorities for sidewalk development, roads served by transit should be given priority.

Improve Transit Servicability of Neighborhoods and Employment Sites. (Measure 2e) Many newly developed neighborhoods are designed to prevent through access. This is desirable in eliminating through automobile traffic, with its negative effects on the quality of residential life. However, such street plans can often promote greater automobile dependency by making it economically difficult for buses to penetrate the neighborhoods and provide convenient pedestrian access.

This promotes greater dependency on park-and-ride lots as a strategy for gaining transit ridership, with the attendant high costs these entail. Typical park-and-ride lots cost $5000 to $15,000 per space and $150 or more per year in operating and maintenance costs. It can often be less expensive to provide more extensive collection and distribution services, relying on the far less expensive pedestrian access system, than to face the potential political difficulties and costs of siting and building park-and-ride lots, which generate their own traffic.

Neighborhood street designs that thwart through automobile traffic should recognize the needs for inter-neighborhood transit, bicycle, and pedestrian paths. Internal subdivision streets not otherwise automobile-connected directly to major nearby arterial roads could be provided in some cases with short connector roads reserved solely for buses, bicycles, and pedestrians. Adjacent subdivisions with their internal street systems not otherwise automobile-connected to each other could in many cases be provided with similar short reserved connector links. Even if such connectors are not provided at the time of development, right-of-way for such connectors should be reserved at time of subdivision.

The absence of such inter-neighborhood connectors in some areas of the U.S. 29 corridor, for example, prevents effective bus access to large apartment buildings in the Paint Branch area north of White Oak. There, reopening a long-closed bridge connecting two neighborhoods might lead to a significant increase in transit use by sharply reducing the circuitry of bus routing.

Other problems afflict some suburban employment developments, where the work sites are set far back from the roads where buses stop, forcing transit commuters to walk across large parking lots through cruising traffic to reach their jobs. Site design less hostile to those arriving at the work site by means other than the automobile could provide encouragement to employees who use transit, bicycles, their feet, or some combination of the three to get to work. While many developers are beginning to address some of these problems, far more could be done to encourage the provision of good transit, bicycle, and pedestrian access to suburban employment clusters through better site design and planning.

<u>Improved Bicycle-Pedestrian Planning.</u> (Measure 6f) Although Montgomery County residents and workers are very dependent on the automobile for mobility, everyone is a pedestrian at least some of the time and a substantial portion of County residents use bicycles on at least an occasional basis for recreation or local travel. About three percent of County residents walk as their principal means of commuting to work. About one-half percent of residents use bicycles as their principal commuting mode. Two to three times this number of residents use these non-motorized modes occasionally for commuting and many more rely on walking or bicycling to get to and from public transportation for commuting.

In the Silver Spring business district nearly 5% of workers walk or bike to work according to the 1979 Metro After Study. At the National Institutes of Health, more than 200 workers, comprising over 1.5% of the workforce, regularly bike to work.

Problems with a lack of public facilities serving non-motorized travel demand rarely capture headlines because these problems tend to be very localized, despite their widespread occurrence, and because non-motorized travelers remain largely unorganized as a distinct political constituency, unlike automobile interests. Nevertheless, the shortage of public facilities for bicycle and pedestrian transportation tends to exacerbate road congestion problems by discouraging the use of non-motorized modes for local travel and transit access.

If the County is to place a significant reliance on traffic alleviation measures to accommodate future growth in staging ceilings, a increased effort to improve the pedestrian and bicycle transportation infrastructure in Montgomery County will be needed. Many of the transportation alleviation measures discussed in this report rely on increased use of non-motorized transportation for their success. Better bicycle and pedestrian planning will enhance access to public transportation and increase the portion of commute trips that can be made entirely by non-motorized means. These needs, already recognized in the County Council's adoption of the Personalized Bicycle and Pedestrian Commuting Demonstration Program as part of the STTAP, can be met by creating or allocating several additional County staff positions to deal with various aspects of bicycle and pedestrian transportation planning and marketing.

<u>Fostering Transportation Management Associations.</u> (Measure 8c) This strategy is the broadest of all in this cluster of traffic alleviation measures rated M/M/M. It is a measure that relies extensively on public-private cooperation and voluntary private sector initiative to reduce peak hour vehicle trip demands. This measure is a weaker and partial version of the previously discussed concept of a TSM Ordinance. Whereas the TSM Ordinance relies in part on the implied or explicit threat of sanctions against private employers for non-compliance with trip reduction programs, this measure relies solely on goodwill, good corporate citizenship, and peer pressure to induce existing employers to adopt trip reduction programs. The recently-organized North Bethesda TMA is a good example of this approach.

A Transportation Management Association (TMA) is typically an organization formed by a group of private businesses, employers, developers, and representatives of local governments to improve the management and provision of transportation services in an area. One of the most common motives for the formation of TMAs has been the need to find solutions to pressing traffic problems encountered in fast-growing suburban activity centers. Although varied in their success, TMAs have in other communities imposed fees upon their members to finance special local area transit services, organized ridesharing and vanpool

programs, and developed a variety of other programs, usually through the office of a TMA-sponsored Transportation Coordinator, designed to encourage those working within the area to use modes other than the single passenger automobile.

The TMA concept, which is now being tested in North Bethesda, is jointly funded by the MCDOT and the private sector. Preliminary results from this initial experience should become available by early 1988. The conclusions from this study may be applied to other areas of the County where traffic congestion alleviation is warranted. Should this approach yield the anticipated measurable and sustainable traffic reductions, this alleviation measure may provide some substantial new staging ceiling capacity where it is applied. Because the measures are experimental and the TMA concept is not yet proven effective, it would be wise to await the results of TMA activities on trip reductions before granting additional staging ceiling. If the voluntary approach is not successful in eliciting the cooperation of private employers, the County might consider a TSM Ordinance.

5. Highly Difficult, Highly Effective Measures With Low or Moderate Cost

Several alleviation measures involve only low to modest monetary costs but entail potentially greater political or administrative problems. Nonetheless, they merit consideration due to their substantial potential for reducing traffic congestion. Most of these measures are based on increasing the cost of automobile use in central areas, where commuters now find subsidized low cost or free parking, or otherwise ensuring that the automobile has to compete on level ground, economically-speaking, with other commuting modes. These alleviation measures are:

7b(ii): Peak period surcharge from public parking garages.

7c: Restricting parking supply.

7e(i): Equalization of commuter subsidies.

9c: HOV Area with Exception Permits for Silver Spring and/or Bethesda.

One additional measure which is not recommended except in times of transportation crisis but which falls into this L/H/H category is the imposition of odd-even license restrictions.

Peak Period Surcharge. (Measure 7b[ii]) The peak period supplemental parking fee is a new concept that would impose a supplemental congestion fee, in addition to the parking fee, of perhaps $2 to $4 on non-carpools entering or departing parking garages with their cars during the peak periods of travel. This might be implemented alone or in conjunction with higher all day parking fees and other alleviation measures.

A peak period surcharge would encourage automobile commuters to either shift to another mode for their commute or to change their work commute hours to less congested times of the day. The surcharge would be consistent with a policy that says that the true marginal cost of providing the public parking spaces should be charged to those users who create the need for extra spaces.

Unlike the "HOV Area with Exception Permits" measure, peak period surcharges would not affect through traffic in Silver Spring and Bethesda. However, the introduction of limited peak period HOV restrictions on key streets in these central areas together with the surcharges could offer major traffic reductions.

Restricting Parking Supply. (Measure 7c) Capping the total parking supply for the central areas of down-County employment centers would be a way of driving up the cost and difficulty of parking. Such measures have already been used with success in the downtown areas of Boston and San Francisco and are now under consideration for the proposed Silver Spring Transportation Management District. Implementation of higher parking costs would affect the market demand for parking in the County's employment centers and might on its own reduce the perceived need to develop additional parking capacity. If the increase in public parking fees resulted in an increase in the free or subsidized private parking supply offered to employees, regulation of this private parking could be considered.

Equalization of Commuter Subsidies. (Measure 7e[i]) The equalization of commuter subsidies could have a major effect on commuter mode choice throughout the County. This measure would require legislation from the Council to require employers or building owners providing free parking to employees to provide equivalent subsidies to non-automobile commuters. This could take the form of subsidized transit passes, free secure bicycle parking and showers at the workplace, or equivalent cash subsidies to those not driving to work. It could provide an incentive for employers to begin charging employees for parking now provided as a free employee benefit.

This measure is similar to the concept of the TSM Ordinance but takes a somewhat more active stance in requiring the private sector to take actions that will lead to employee vehicle trip reductions. These actions may help end the practice of employer-provided free parking. If proven successful, a law equalizing employer commuter subsidies could provide a substantial increase in staging ceiling capacities not only in the down-County areas, but also in the fast-growing up-County employment centers.

As part of the adopted STTAP, a County-wide Task Force was to have been established by the MCDOT and representatives of both the public and private sectors to study alternative ways to induce private sector employees to utilize transit and alternative modes. This Task Force was to evaluate the feasibility and desirability of such legislation. Thus far, such a Task Force has

not been established. The experiences of the North Bethesda TMA should also provide guidance on whether voluntary approaches alone can induce existing private employers to reduce their subsidies for automobile commuting. If they do not succeed in this regard, the County should consider adopting legislation to encourage action.

<u>HOV Area with Exception Permits for Silver Spring and/or Bethesda.</u> (Measure 9c) One of the most effective alleviation measures that could be employed in the down-County employment areas would be the creation of a High Occupancy (HOV) Area in the Silver Spring and Bethesda central areas. HOV lanes have been widely adopted across the United States as a highly cost-effective way of allocating scarce peak period road capacity on the basis of vehicle occupancy and offering an advantage to carpools and transit. Northern Virginia has made extensive use of HOV lanes, which are found on the Shirley Highway, I-66, and Dulles Access Road. An HOV Area is the same concept applied to the congested roads of a town center area, where expansion of streets is undesirable or unfeasible.

Exception permits soften the impact of the HOV restriction by permitting continued unimpeded access through the HOV area to solo drivers who pay a modest toll. Thus, out-of-town visitors, salespeople, and others who want or need to drive alone through the HOV area could do so without problem. These drivers would purchase monthly or daily exception permits at stores, by mail, or at gateways to the area, displaying them on their car's windshield. Residents of the affected area might be offered the exception permits free or at a discounted price.

HOV Areas, usually adopted with exception permits, have been used in several European and Asian cities with dramatic success to achieve major reductions in peak period traffic entering central employment areas. There are many ways the concept could be applied to the central areas of Silver Spring and Bethesda. One approach would be to limit the use of the central area streets within these areas to automobiles with two or more passengers, buses, taxis, and bicycles during the morning peak hours (such as 7 to 9:30 am), when most of the traffic consists of home-based work trips.

Revenue from the exception permits could be used to improve transit and non-motorized transportation for the central areas. Parking garages at the periphery of the HOV Area could capture many single passenger trips at the edge of the town centers, with free circulator shuttle buses to distribute people to employment sites and rail transit centers. Diversion routes around the HOV area would need to be signed for drivers of single passenger automobiles on through trips who wish to avoid buying an exception permit. Traffic operations measures to improve traffic flow on these diversion routes might be needed as well. Careful consideration would need to be given to enforcement strategies and to public information systems for out-of-town visitors.

Cities introducing HOV Areas--with four-person HOV requirements and exception permits costing roughly $40 a month--as part of comprehensive traffic management strategies have reduced traffic entering their HOV areas by as much as 75%, with up to 43% reductions in overall daily traffic in the HOV areas and a doubling in carpool and transit use.

Implementation of such an alleviation measure in Silver Spring or Bethesda with a two-person carpool requirement could be expected to cause major increases in the average automobile occupancy of peak period traffic through and to these major employment centers as well as sharply higher transit ridership. Although further study would be needed before implementing an HOV Area, it is likely that this approach would cause substantial reductions in traffic and make possible major increases in staging ceilings for Silver Spring and Bethesda. Such a measure could be combined with reserved bus lanes and other improvements in these downtown areas to offer far better travel conditions for transit vehicles, pedestrians, and cyclists.

6. High Cost, Low to Moderate Difficulty, But Highly Effective Measures

This cluster of measures involves making major investments in the public transportation system to help attract automobile drivers from their cars during peak hours. One of these measures --the selective doubling of bus frequencies--could involve a major expansion of the bus fleet and the number of drivers. The other measures in this group focus on improving the attractiveness, convenience and productivity of the bus transit system through improved route design, system management, and the use of state-of-the-art information and communications technology. The measures in the cluster are:

5c: Selective Doubling of bus frequency.

5i(ii)2: Develop real-time bus passenger information system.

5i(ii)3: Devise real-time phone bus information system.

5m(ii): Signal Preemption for Buses.

5m(iv): Transit centers with pulse service.

6b(i): Major expansion of bicycle/pedestrian facilities.

8e: Enact TSM Ordinance w/enforcement.

Selective Doubling of Bus Frequency. (Measure 5c) Doubling the frequency of bus service on many of the routes in the County in the peak hours would be a bold but expensive proposition. It would likely attract many more people to use transit for commuting. Although this approach alone could have effects on peak period traffic sufficient to provide new staging capacity, more carefully planned increases in bus frequency along key corridors,

combined with marketing, improvements in transit user amenities, and increased automobile user charges or restrictions would likely be the most cost-effective strategic approach.

The best time to experiment with significantly higher bus frequencies is at the same time that actions are being taken to reduce the incentives offered for single-passenger automobile commuting. These are the times when more people than usual are reexamining their choices of how they get to work.

It is far easier for the County to increase Ride-On service levels than Metrobus service levels, due to existing contractual and managerial structures. The County might find it useful to boost bus frequencies particularly in several areas. Various HOV options are being examined in the U.S. 29 corridor to alleviate traffic congestion problems there. The recently initiated free bus service there to Briggs Chaney has attracted high ridership--more than 1300 a day. The County might experiment by doubling the frequency of this bus service and instituting a modest fare to offset some of the costs of increased service. For maximum impact, this action might be initiated concurrently with a further doubling of parking costs in the Silver Spring central area garages, a concerted transit marketing program, the development of new feeder mini bus services penetrating into residential areas in Fairland/White Oak, and the installation of secure bicycle parking at key bicycle-accessible bus stops in the U.S. 29 corridor.

The County might also experiment with increased bus service frequencies to North Bethesda area Metro stations and activity centers. For maximum impact, these increases might be combined with an increased frequency of Metrorail service beyond Grosvenor, focused transit marketing, the provision of bus priority treatments in congested areas, and measures to discourage local employers from providing free commuter parking.

<u>Development of Real-Time Bus Passenger Information System and Real-Time Telephone Bus Information System.</u> (Measure 5i[ii(2)]) Increasing bus service frequencies is one way to reduce passenger waiting times and thereby attract automobile drivers to transit. Another way, to achieve the same effect with far less increase in transit operating costs would be to make full use of available advanced data processing and communications technology for passenger information systems.

It would be possible to install radio and microprocessor equipment on buses operating in the County along with radio receivers and information display units at major bus stops. This equipment would inform passengers at bus stops of how long they must wait until the next bus to their destination. The same on-board bus radio/microprocessor equipment could relay the position of the bus to a central dispatching and information center. Before leaving their home or office, potential bus passengers could call a phone number for real-time information on when the next bus to their destination is expected to arrive at their bus

stop. Thus, passenger waiting delay at bus stops could be reduced in most cases to five minutes or less, regardless of the infrequency of the bus service.

Moreover, if a bus were to fall behind schedule, the otherwise unavoidable problem of bunched up buses--the first one full, and one or two right behind riding empty--could be circumvented by real-time bus dispatching. This would also improve bus schedule adherence.

Having installed radio communications equipment on-board buses, it would be a relatively simple matter to utilize this equipment for traffic signal preemption, further reducing schedule adherence problems caused by congestion delays and improving bus speeds and productivity. Signal preemption is discussed further below.

The technology for such a real-time bus information system has been demonstrated and applied in various forms in Japan and Europe. In the United States, General Motors conducted a demonstration of some of this technology in the late 1970s in Cincinnati, Ohio. Advances in microprocessor technology since that time have, if anything, made this technology more practical and economical. Although it may not be available from American manufacturers, European and Japanese suppliers advertise such technology periodically in the U.S. market.

Signal Preemption for Buses. (Measure 5m[ii]) Traffic signal preemption can operate in various ways, but all of these permit a bus to hold the green phase on a traffic signal it is approaching. By altering the length of the green phase to permit the bus to pass through the intersection before the light turns red, the bus is speeded on its way, improving both transit travel times and schedule adherence. These have obvious positive influences on potential transit ridership and the diversion of automobile drivers to public transportation. Whether applied in conjunction with an advanced bus information system or not, signal preemption can be one of the more cost effective investments in public transportation, particularly where significant intersection congestion can be encountered. There are some circumstances in which signal preemption can disrupt carefully timed traffic signal system phasing plans. However, because Montgomery County has a real-time computerized signal system, it is likely that the systems computers could be programmed to accommodate transit preemption, putting appropriate limitations on the green signal phase delay to avoid serious system disruption while favoring public transportation.

Transit Centers With Pulse Service. (Measure 5m[iv]) Another very cost-effective alleviation measure that can boost the utility of public transportation in suburban areas through improved management of resources is the development of transit centers and a pulse service strategy. These are relatively new concepts in transit operations that have been successfully demonstrated in different forms in a number of suburban areas such as

Portland, Oregon and western Canadian cities, and to some extent in Montgomery County, Pennsylvania, outside of Philadelphia.

These service strategies are based on the realization that the predominant travel demands in contemporary suburban areas are not radially oriented towards the major regional downtown area but rather are intrasuburban movements between smaller suburban activity centers. To meet the transit needs of this new non-radial pattern of travel demand, transit services need to be reoriented to provide fast service between the smaller activity centers. Because no one bus route will likely connect the disparate origins and destinations of the majority of travelers, efforts should be directed to reducing transit transfer delays wherever possible.

This can be done by creating transit centers at most major suburban activity centers, such as regional shopping centers, major employment concentrations in the traditional town centers, and at Metro stations. All or most buses serving these centers are scheduled to arrive at about the same time, to layover for a relatively short common time period, during which predictable transfer connections can be made, and to then leave the transit centers at about the same time. Thus, transfer delay is short and predictable, and hence rather less onerous than the unpredictable and potentially long transfer delays that often occur when switching between two bus lines with headways of 20 or 30 minutes.

Ride-On used the pulse service concept when offering only limited service in the Gaithersburg area. With the opening of the Red Line to Shady Grove, it moved away from the concept because of significant variance in the route length and congestion delays experienced by different bus routes.

A study of the ways in which pulse service might be used to reduce transfer delays for at least some of the major transit transfer centers in the County might be fruitful. Opportunities may exist in the Friendship Heights area, among others.

The Ride-On system has developed informal transit transfer centers at several Metro stations and shopping centers, such as Wheaton and Langley Plazas, Montgomery and Lakeforest Malls. Full development of these centers has been impeded by resistance on the part of many shopping center owners to increased bus service operated on their sites and the lack of funds to provide quality terminal area improvements. The County should reopen negotiations with shopping center owners where appropriate to investigate possibilities for construction of actual transit centers with efficient and proper bus, pedestrian, and bicycle access routes across the site. These centers could include amenities designed to make them attractive to both the shopping center owners and the public, such as community meeting rooms, day care facilities, art galleries, and public access computer and video labs. If the owners of regional shopping centers are unwilling to negotiate in good faith to provide transit access that is clearly in the

public interest, selected use of powers of eminent domain might be considered, as in cases where land is taken for needed road right-of-way.

Major Expansion of Bicycle/Pedestrian Facilities (Measure 6b(i)). As the discussion of bicycle/pedestrian planning (measure 6f) indicated, non-motorized travel accounts for a significant portion of current commuting in Montgomery County despite the many gaps in the current infrastructure provided for pedestrians and cyclists. Inside the Beltway, more than 10% of all residents use walking or bicycling for part or all of their commute trip. By planning area, 4% to 7% of inside the Beltway residents reported walking or cycling as their primary means of getting to work in 1984; more than half of all inside the Beltway residents who rode transit as their primary means of commuting walked or biked to bus or rail services.

Outside the Beltway, where there are far fewer sidewalks, pedestrian crossings, and bicycle facilities, non-motorized modes were reported as the primary means of commuting by 3% to 4% of the residents in Gaithersburg, Rockville, North Bethesda, and Fairland. Walking accounted for more than one-third of all transit commuter access trips in Gaithersburg, Rockville, North Bethesda, and Wheaton in 1984 and for more than 20% of transit commuter access in all but the most rural areas of the County. In the I-270 corridor, roughly 6% to 8% of residents thus relied on non-motorized means for at least a portion of their commute to work in 1984, prior to the opening of the Red Line extension.

In past years, the proportion of County capital spending dedicated to non-motorized transportation infrastructure has failed to match these proportions of use. Capital investment in non-motorized modes of transportation must keep up with the level of use of these modes if walking and bicycling are to be viewed as legitimate and viable transportation alternatives. Indeed, it may be justified to increase the level of investment in these modes beyond the share of current use to catch up with the massive backlog in facility needs and to promote greater use of walking and bicycling for commute trips.

The County might consider setting a goal of providing investment for non-motorized modes equal to 10% of the County's spending on roads, automobile parking, and traffic improvements. This would be equal to about $6 to 7 million per year, still far less than the County now spends solely on parking structures. Such a level of investment, combined with improved planning and marketing of non-motorized travel and improved intermodal integration with transit, could have major impacts on peak hour traffic congestion after several years of effort, especially if combined with other measures that discourage solo automobile commuting.

TSM Ordinance. (Measure 8e) A broad-based and very flexible approach to achieving modally balanced incentives for employee commuting would involve passage of legislation modeled on the

Pleasanton, California Transportation System Management Ordinance, passed in 1984. Somewhat similar model legislation has been put forward by the King County Council of Governments in the Seattle, Washington, area. Passage of such an Ordinance might be one of the best ways to achieve the cooperation of existing private sector employers in the development of employee vehicle trip reduction programs for congestion alleviation. The Transportation Management District proposals for the Silver Spring and Bethesda CBDs include such legislation.

While there are many possible variations that might be devised, a TSM Ordinance in general would call for employers, industrial and office parks, and the County to work together to reduce traffic on County roads. One of the requirements of the ordinance could be for all industrial and office parks, businesses located within industrial and office parks, and employers with 100 or more employees on a single shift to prepare and implement a TSM Program. This would include an information dissemination program and should include any reasonable and appropriate combination of measures to help achieve reduction in traffic generated by employees during peak travel periods. The effectiveness of a TSM Program is increased considerably if it is designed to meet performance goals stated in the law. In Pleasanton, the ordinance requires a 45% reduction in the vehicle commute trips during the peak hours that would occur if all peak hour trips were made by solo drivers. This reduction is to occur in stages, with a 15% reduction in the first year and an additional 10% reduction in the next three years.

Partial responsibility for overseeing implementation of a TSM Ordinance can be delegated to a Sub-county TSM Task Forces as is proposed for the Silver Spring and Bethesda CBDs. Under a TSM Ordinance, either the employers or the County DOT could be responsible for conducting annual surveys of employee commute modes, work schedules, and employee residential distributions. The County DOT could summarize the survey results in an annual report.

The question of how to enforce the Ordinance provisions in the face of persistent non-compliance would need to be addressed in legislation. The Pleasanton Ordinance provides fines of $50 to $250 for failure to provide information required by the ordinance; failure to comply with the Task Force in development of effective TSM programs is subject to fines of $250 per day after City Council review and finding of non-compliance. Stranger fines may be necessary if persistent non-compliance becomes a problem.

The TSM Ordinance approach could have a major effect on staging capacities County-wide if it was successful in gaining the compliance of existing employers in sustainable peak period vehicle trip reduction programs. This public/private-sector joint initiative approach may also be beneficial in the rapidly growing up-County employment areas of North Bethesda, Gaithersburg, Germantown, and Fairland/White Oak, where there are fewer

opportunities to introduce alleviation measures geared towards central area automobile restraint, such as HOV zones, traffic cells, and high public parking fees. However, uncertainty over the nature and success of the diverse programs that this broad approach would engender would make it important to avoid releasing additional staging ceiling capacity in any policy area on the basis of this strategy until measurable and sustainable peak hour vehicle trip reductions could be demonstrated on an area-by-area basis.

7. High Cost, Highly Effective, and Highly Difficult Measures

This cluster of measures involves the highest potential costs in both monetary and political terms but these measures offer very large potential reductions in peak hour vehicle traffic. In some cases these might provide the opportunity for increases in staging ceilings equivalent to several years of growth at current levels. These measures fall into several types--the provision of major infrastructure dedicated to transit use, automobile use restrictions in central areas, and road pricing. Many of these measures are more extensive or more focused variations of strategies discussed previously in this report. The measures identified in this cluster include:

5m(i): Reserved transit Rights-of-Way.

9c: East-West Transitway linking Silver Spring and Bethesda.

9a: Traffic cell systems in Silver Spring and Bethesda.

9b: Automobile restricted zones in Silver Spring and Bethesda.

9e: Peak Period HOV Restricted Areas in Silver Spring and Bethesda without exception permits.

3d: Road Pricing on major roads.

<u>Reserved Transit Rights-of-Way and East-West Transitway.</u> (Measure 5m[i]) The provision of reserved transit rights-of-way, whether for buses, trolley-buses, light rail vehicles, heavy rail, automated guideway transit, or dual-mode transit, is one of the foremost ways of attracting new ridership to public transportation. When transit vehicles--such as buses, trolley-buses, or light rail--operate in mixed traffic conditions, almost invariably transit is slower and relatively less attractive than automobile use.

Given their own right-of-way, transit vehicles can more readily compete with automobile speeds, even without grade separation at crossings. With both reserved right-of-way and partial

or full grade separation, transit can often surpass point-to-point automobile travel speeds. The dedication of reserved right-of-way for a transit service usually also gives that service a clear positive distinction in the eyes of the public. Even those who do not use the service have a clearer sense of where transit service is and where it goes. In this way, reserved transit rights-of-way can reinforce or encourage ridership levels and stimulate development potential to a greater degree than conventional bus service.

The development of the Metrorail system in Montgomery County has laid an excellent foundation for the further extension of a dedicated transit network. A number of possibilities still exist to preserve, create, and extend land reservation for dedicated transit rights-of-way. A particular example, currently under study is the proposed future extension of transit service from Shady Grove to Germantown and north. This right-of-way location needs to be firmly established and protected to ensure that further development does not occur within its path, thus driving up costs and reducing project feasibility. The study is divided into two phases, beginning with the Planning Department's evaluation of the location of the alignment and concluding with the Transportation Department's assessment of candidate transit operations. The former study is a mid term effort to locate and reserve the right-of-way while the latter is the longer term implementation of transportation services.

Another on-going project in this category is the proposed East-West Transitway that would use the B&O railway line right-of-way to provide a public transit link between the downtowns of Silver Spring and Bethesda. The study by the Transportation Department is reviewing two primary options of light rail and guided trolley bus. If additional funding is made available, the selected alternative will be taken into a more detailed design phase for development as a proposed capital project. This would offer the possibility for a combination of significant increases in staging ceiling capacity and enhancement of down-County transportation conditions. This project could be realized by the early to mid-1990s.

The County should begin to explore the feasibility, costs, and desirability of developing a light rail or dual-mode transit network to (1) provide improved intrasuburban travel, (2) feed riders into the Metrorail network from currently unserved higher density development areas, (3) reduce dependency on petroleum-fueled transportation, (4) help foster continued unimpeded economic development, and (5) further enhance the environmental quality of life in the County. New legislation at the State level has been introduced to specifically authorize planning and right-of-way reservation for mass transit, including light rail. While, as mentioned above, this authority currently exists, the intent of the proposed legislation is to highlight and encourage light rail transit.

Although the costs of light rail development are not inconsequential, these costs can be kept quite affordable--in the range of $5-30 million per track mile--by avoiding extensive tunneling. The fast-growing Western Canadian cities of Edmonton and Calgary, with populations slightly less than Montgomery County, have both recently constructed modern light rail systems for less than $18 million per track mile, including relatively short underground segments where needed to overcome barriers.

Light rail or dual-mode transit could not be expected to provide traffic alleviation within the six year time-frame considered for this analysis. However, steps taken now to initiate the evaluation of such services and facilities for key development corridors in the County could possibly provide very large amounts of additional staging ceiling capacity by the late 1990s. Identification and reservation of potential right-of-way for transit is a mid-term activity which must precede the longer term development of specific transit projects for implementation.

<u>Traffic Cells, Automobile Restricted Zones, and Auto Occupancy Restrictions for Silver Spring and Bethesda.</u> (Measure 9a) These three measures are all strategies that allocate scarce road capacity solely on the basis of vehicle capacity or mode, unlike HOV areas with exception permits, which allocate road capacity on the basis of both vehicle occupancy and user fees. While exception permits allow some people to buy their way out of the central area restriction, thereby defusing to some extent political problems associated with the restriction on automobile use, the above subcluster of measures would not provide this means of exemption for the affluent. All of these measures would seek to reduce in some way the number of automobiles driven to and/or through these down-County central areas.

Traffic cells are a form of automobile restraint that has been used in a number of cities to prevent through automobile traffic in central areas. The Downtown Crossing in Boston is one version of this concept; others are found in cities ranging from Gothenburg and Stockholm, Sweden, to Kobe, Japan. Traffic cells divide an area such as an urban business district into different zones which are separated by boundary streets. Although single passenger automobiles are barred from crossing or using these boundary streets, buses, pedestrians, taxis, and cyclists can all cross or use these streets unimpeded. Automobile drivers who wish to cross these boundaries must travel circuitous routes using major streets that ring the traffic cell system. By means of this approach, local travel by means other than automobiles is encouraged. Traffic cells thus shift traffic from the interior to the periphery of the affected area and encourage alternate modes of transportation. Bus priority measures, parking restrictions, transit improvements, pedestrian streets, bicycle facilities, and other alleviation measures are often combined with traffic cells.

In adapting the traffic cell concept to Silver Spring or Bethesda, it might be desirable to permit multiple-occupant automobiles to cross internal cell boundaries in some key locations,

barring only single-passenger autos. The cell boundary streets could be used as reserved bus and pedestrian streets. Parking garages at the periphery could be served by free or very inexpensive and very frequent shuttle bus service operating on and across the cell boundary reserved bus streets. Modification of existing vehicular circulation patterns would be needed, with measures taken to ensure sufficient capacity on the streets designated as the ring road. It might be possible to provide this ring road capacity on existing streets without widening or major reconstruction through the banning of on-street parking, the creation of one-way concentric ring pairs, the banning of left turns at many or most intersections, or other traffic operations strategies.

As part of a comprehensive traffic management strategy using traffic cells, it might also be desirable to introduce traffic tranquilized street designs (which the Dutch call "woonerfs", listed as measure 2c(iii)) into residential areas adjoining ring roads to discourage inappropriate traffic intrusion into neighborhoods. These street designs force automobiles driving in the street space to operate at the pace of a pedestrian. Although automobiles are not barred from these traffic tranquilized streets, every aspect of the street design reinforces the sense that the street space belongs to the pedestrians, playing children, cyclists, and chatting neighbors who may use the area freely. In such street designs, there are no sidewalks and bricks or stones are often used as the paving material. Formerly straight streets become serpentine, with short turning radii between offset groups of diagonally parked cars, children's playgrounds, benches, and clusters of bushes and trees. These types of street designs have become very common throughout European cities and new town suburbs over the past decade, often being introduced together with traffic alleviation measures such as traffic cell systems.

A less systematic approach to central area traffic management than traffic cells is the use of isolated pedestrian and transit streets. Depending on which streets are chosen, the effects on area traffic congestion can be minimal or significant. In the Silver Spring area, for example, major traffic alleviation benefits might result from turning Colesville Road between East-West Highway (by the Metro station) and Georgia Avenue into a street reserved for transit, pedestrians, and cyclists only. For this action to offer positive congestion relief, other measures would be needed to ensure that a significant amount of the traffic now using this road was shifted to transit, carpools, or non-motorized travel and that the remainder of the diverted traffic could be routed completely around the central area of Silver Spring.

A variant of this idea would be to impose automobile occupancy restrictions on key central area links or at major gateways to the Silver Spring or Bethesda central business districts during am and/or pm peak hours, granting no exceptions to the HOV restriction. For example, all automobiles carrying two or more

passengers might be permitted free passage through the heart of Silver Spring and Bethesda at all hours, but single passenger automobiles might be barred from using Georgia Avenue and Colesville Road south of Spring Street, or Wisconsin Avenue and Old Georgetown Road within the several central blocks of Bethesda between 7 and 9:30 am on workdays. Or, the restriction might be applied to all traffic southbound on Colesville Road from the Beltway to the D.C. line each weekday morning, with comparable restrictions on Georgia Avenue south of the 16th Street cut-off.

Such measures would substantially increase the automobile occupancy rate not only within these central areas, but also north of the Beltway. In imposing such restrictions, measures would need to be taken to offer drivers improved transit and ridesharing services and to protect neighborhoods from traffic intrusion caused by those seeking to circumvent the restrictions. Appropriately sited traffic tranquilized streets and other less sophisticated neighborhood traffic controls could deal with this potential problem.

Road Congestion Pricing on Major Roads. (Measure 3d) An alternative to allocating scarce road space purely on the basis of vehicle occupancy is to allocate capacity purely on the basis of price. Newly demonstrated technology makes it possible to charge road user fees on the basis of the time of day of automobile use on congested roads. Cars can be equipped with either electronic license plates or bar coded stickers readable by optical scanners to permit sensors in or on roads to identify the vehicle for purposes of toll payment or later billing. Road use fees can be set to charge far more for driving on a road when it is congested than when there is little traffic on the road.

Hong Kong undertook an experiment with road pricing in 1983-85 using electronic license plates, which drivers were forced to buy at a cost of about $20 each to affix permanently to their cars. These licenses automatically identified themselves to sensing loops in the road connected to a central computer. The computer recorded the tolls and billed car owners monthly. Although technically successful, this experiment failed politically, with motorists unconvinced that their fees would be offset by lower taxes and with many people concerned about the privacy violations of having their routes monitored by computer.

Similar technology has been used for truck identification and clearance in Oregon and 12 other states. The New York-New Jersey Port Authority is planning a project to use electronic license plates to assess tolls on buses using the Lincoln Tunnel. Optical scanner technology, which for identification uses bar coded stickers costing only about 65 cents each, has been used for automated non-stop toll collection on Delaware River Port Authority Bridges for 15 years.

It might be possible to use similar technology in Montgomery County to assess road user fees for congested roads. By having

motorists pay road fees directly related to the congestion level of the road on which they operate, congestion levels would likely decrease substantially as people shifted to other modes for peak hour trips or shifted their trips to less congested time periods. However, Federal laws would prohibit the imposition of any user fee for Interstate highways in the County. The political problems in developing any widespread program of road user fees would likely be formidable.

8. Conclusions

A considerable number of the traffic alleviation measures discussed in this report will be implemented in conjunction with the proposed Transportation Management Districts and Transportation Management Associations in the County. Unfortunately, most of the measures do not have a track record of proven results; and even when they do, certain local characteristics may cause some measures to perform differently here than they do in some other parts of the country. A measure's impact on travel behavior, therefore, is highly variable and difficult to predict.

Development pressures may cause strong temptations to increase the staging ceiling now on the presumption that future traffic alleviation measures will remove a certain number of trips from the roads. In such cases, developments may ask for construction approval prior to obtaining actual results on the effectiveness of the alleviation measures. A more conservative, and perhaps wiser approach, is to implement the experimental alleviation measures in limited areas on a demonstration basis, and then take a "wait-and-see" attitude to see what the results will be before granting development approvals. Approvals would thus be contingent on the measures' actual rather than presumed success.

CHAPTER 3

ALTERNATIVE TRANSPORTATION STAGING CEILINGS

INCLUDING
POLICY AREA NARRATIVES AND CHARTS

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ALTERNATIVE TRANSPORTATION STAGING CEILINGS INCLUDING POLICY AREA NARRATIVES AND CHARTS

This chapter presents Staging Ceilings that were adopted in the FY 88 Annual Growth Policy (AGP) and shows potential Alternate Transportation Staging Ceilings to be used in the process of adopting Staging Ceilings for the FY 89 Annual Growth Policy. These alternate Staging Ceilings correspond to the five scenarios described in the previous chapter. This chapter first presents a County-wide summary of these alternative transportation staging ceilings. This chapter then presents policy area by policy area narratives that discusses the situation in each area. Included with the narratives are Staging Charts that depict the relationship among: (1) these alternatives, (2) the trends of completions, (3) forecasts of development and (4) the pipeline of previously approved subdivisions.

A. <u>SUMMARY OF ALTERNATIVE STAGING CEILINGS</u>:

Table 3.1 presents the FY 88 Annual Growth Policy (AGP) Staging Ceilings for jobs and housing units for each policy area where ceilings apply. Column A of this table presents the pipeline of approved subdivisions as of October 8, 1987 and excludes building completions through the end of 1986. Column B presents the Staging Ceilings adopted for each policy are that was adopted in the FY 88 AGP. Column C shows the remaining capacity for jobs and housing units for each policy area and is computed by subtracting Column A from Column B. Column D is the first set of Alternative Staging Ceilings Scenarios for each policy area, the Anticipated Ceilings. They are based on the normal progression of transportation project in the County's CIP or the State's CTP. That is, projects for which 100% of the expenditures for construction are estimated to occur by the fifth year of the adopted FY 88-93 CIP or the fifth year of the FY 87-92 CTP are anticipated to progress to the fourth year of the FY 89-94 CIP or the FY 88-93 CTP. The transportation projects assumed for the Anticipated FY 89 AGP Scenario are listed by policy area in Table 2.2 and shown on Map 2.2 in Chapter 2. Column E of Table 3.1 presents the remaining capacity for each policy area.

Table 3.2 presents the second alternative set of possible Staging Ceilings. It is based on all the transportation projects used in determining the ceilings for the anticipated FY 89 AGP and adds transportation project that were proposed by the County Executive and the Montgomery County Department of Transportation. They have identified projects that could be accelerated to the point where they could augment the fourth year of the anticipated FY 89-94 CIP or FY 88-93 CTP. This Scenario is therefore referred to as to as "FY 89 Augmented A." The ceilings made available by the set of transportation projects is shown in Column F of Table 3.2.

Table 3.3 presents the third alternative set of Staging Ceilings and is based on all the transportation projects that were used in the development of the first two Scenarios and the addition of a second level of augmentation that was also suggested by the County Executive and the Montgomery County Department of Transportation. This Scenario alternative is referred to as "FY 89 Augmented B." The ceilings made available under this alternative are shown on Table 3.3. The transportation projects used in the development of the FY 89 Augmented A and FY 89 Augmented B alternatives are listed by policy area on Table 2.2 and are shown on Map 2.3.

The fourth alternative set of Staging Ceilings is presented in Table 3.4. It was developed based on what is referred to as the proposed "Revised Test at Subdivision" (RTAS) amendment to the FY 88 AGP. This RTAS amendment to the FY 88 would permit transportation projects that are shown in the fifth, sixth and seventh year of the adopted CIP or CTP to be used in determining staging ceilings under certain conditions. Column J of Table 3.4 shows the staging ceiling that should be used if the RTAS amendments to the FY 88 AGP is adopted. The transportation project used in the development of the RTAS FY 88 ceilings are listed in Table 2.2 and shown on Map 2.4. It should be noted that the proposed RTAS amendment would limit depending upon specific roadway projects to only those whose construction schedule is certified by the Executive as being firm and reliable. Projects which Planning Department staff are recommending to not be counted (shown as NC) due to not being firm or reliable are appropriately shown in Table 2.2

The fifth alternative set of staging ceilings is presented in Table 3.5 and was developed on the assumption that the Revised Test at Subdivision Amendment is adopted. The ceilings developed under this Scenario is referred to as the RTAS FY 89 AGP. These ceilings were developed based on transportation projects assumed in the development of the anticipated FY 89 AGP as well as transportation projects expected to be shown in the fifth, sixth and seventh years of the FY 89-94 CIP or FY 88-93 CTP. The ceiling developed under this alternative are show in Column L of Table 3.5. The transportation project used in the development of the RTAS FY 89 ceilings as listed in Table 2.2 and shown in Map 2.5.

To make the staging ceiling tables easier to understand, the following maps were developed to show for the different policy areas where the remaining staging ceiling capacity is zero for jobs or housing units for the different alternative transportation scenarios used to develop staging ceilings. Map 3.1 show the policy areas where the remaining staging ceiling capacity is zero for jobs or housing for the FY 88 AGP. Map 3.2 show the policy areas where the remaining staging ceiling capacity is zero for jobs or housing units for the FY 89 Anticipated AGP. Maps 3.3 and 3.4 show the policy areas where the remaining staging ceiling capacity is zero for the FY 89 Augmented A AGP and FY 89 Augmented B AGP. While Maps 3.5 and 3.6 show the policy areas where the remaining staging ceiling capacity is zero for the FY 88 RTAS AGP and the FY 89 RTAS AGP.

TABLE 3.1

Anticipated FY89 (5th Yr of FY 88-93 CIP)

POLICY AREA(#3)	A: Pipeline of Approved Subdivions (As of 10/8/87) (Base=1987) (#4)		B: Ceiling Adopted for Use in FY 88 (Based on FY 88 AGP) (Base=1987) (#5)		C: Remaining Capacity Under FY 88 AGP (As of 10/8/87) (Base=1987) (B-A) (#6)		D: Anticipated FY 89 AGP Ceiling Based on 5th Year of FY 88-93 CIP (#1)		E: Anticipated FY 89 AGP Remaining Capacity Based on 5th Year of FY 88-93 CIP (D-A) (#2)	
	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU
Bethesda CBD(#7)	9,833	850					9,246	1,865	(587)	1,015
Bethesda/Chevy Chase(#7)	1,341	707					11,100	4,240	9,759	3,533
Bethesda	11,174	1,557	16,346	4,105	5,172	2,548				
Cloverly(#8)	82	821	591	(468)	509	(1,289)	341	(218)	259	(1,039)
Damascus(#9)	246	535	854	(129)	608	(664)	854	(129)	608	(664)
Fairland/White Oak(#10)	10,006	5,295	5,286	4,240	(4,720)	(1,055)	1,286	2,240	(8,720)	(3,055)
Gaithersburg East	17,548	7,564	14,937	9,545	(2,611)	1,981	14,937	9,545	(2,611)	1,981
Gaithersburg West	20,590	4,222	21,307	7,240	717	3,018	23,307	10,240	2,717	6,018
Germantown East	5,167	2,048	3,996	678	(1,171)	(1,370)	5,746	2,178	579	130
Germantown West	7,935	5,081	6,965	3,124	(970)	(1,957)	6,965	3,624	(970)	(1,457)
Kensington/Wheaton(#8)	2,554	4,875	11,184	5,710	8,630	835	7,184	7,710	4,630	2,835
North Bethesda	9,539	2,593	8,916	2,421	(623)	(172)	8,916	2,421	(623)	(172)
Olney	698	2,922	1,113	3,313	415	391	2,613	5,313	1,915	2,391
Potomac(#11)	428	2,336	3,295	4,493	2,867	2,157	3,295	4,493	2,867	2,157
Rockville(#12)	14,000	850					20,325	2,753	6,325	1,903
Silver Spring CBD(#13)	4,085	383	14,835	3,383	10,750	3,000	14,835	3,383	10,750	3,000
Silver Spring/Takoma Park(#13)	880	207	1,380	824	500	617	1,380	824	500	617
TOTAL CAPACITY FOR NEW SUBDIVISIONS	104,932	41,289	126,330	50,829	31,493	15,450	132,330	60,829	40,322	25,580

[1]The ceilings indicate the amount of jobs or housing units by which the road capacity in the anticipated FY 89-94 CIP or FY 88-93 CTP exceed the estimated level of development as of January 1, 1987. Negative numbers, shown in parentheses, indicate the amount by which the estimated level of development exceeds the anticipated FY 89 ceiling.

[2]Capacity remaining after the pipeline is subtracted from the ceilings desired from road capacity in the anticipated FY 89-94 CIP or the FY 88-93 CTP shown in the previous column.

Footnotes continued on next page

[3]Group I Policy Areas are not assigned staging ceilings. In these areas, subdivision applications are subject to Transportation Local Area Review, as well as to relevant zoning and water and sewer constraints.

[4]Total number of jobs or housing units in subdivisions approved up to October 8, 1987. This total includes buildings which were completed between January 1, 1987 and December 31, 1987.

[5]The ceilings indicate the amount of jobs and housing units by which the road capacity in the adopted FY 88-93 CIP or FY 87-92 CTP exceed the estimated level of development as of January 1, 1987. Negative numbers, shown in parentheses, indicate the amount by which the estimated level of development exceeds the anticipated FY 88 ceiling.

[6]Capacity remaining after the pipeline is subtracted from the staging ceilings adopted in the FY 88 AGP and shown in the previous column.

[7]Staging Ceilings were not adopted for Bethesda CBD and Bethesda/Chevy Chase as separate policy areas in the FY 88 AGP.

[8]Staging Ceilings were adjusted from those adopted in the FY 88 AGP to better balance the projected build out of Jobs and Housing Units.

[9]Pipeline adopted in the FY 88 AGP have been revised to reflect the correction of an accounting error of existing development in the Damascus Policy Area.

[10]Staging Ceilings are estimated based upon roadway level of service standard as a Group III. All of the tests to confirm these values for the ceilings have not been completed as of December 1, 1987.

[11]Staging Ceilings are not used for this policy area.

[12]Staging Ceilings were not adopted for Rockville in the FY 88 AGP. Final interpretation of which projects to rely upon from the Rockville CIP were still under discussion as of December 1, 1987.

[13]Since the FY 88 AGP was adopted, an amendment was made to separate Silver Spring into two policy areas. The Pipeline, Ceiling and Remaining Capacity reflect the numbers that were adopted on November 10, 1987, as part of the Silver Spring amendment to the FY 88 AGP.

TABLE 3.2

FY 89 Augmented "A"

POLICY AREA(#3)	A Pipeline of Approved Subdivions (As of 10/8/87) (Base=1987) (#4)		B Ceiling Adopted for Use in FY 88 (Based on FY 88 AGP) (Base=1987) (#5)		C Remaining Capacity Under FY 88 AGP (As of 10/8/87) (Base=1987) (B-A) (#6)		F Proposed FY 89 AGP Ceiling Based on 5th Year of FY 88-93 CIP Plus Augmented "A" (#1)		G Proposed FY 89 AGP Remaining Capacity Based on 5th Year of FY 88-93 CIP Plus Augmented "B" (F-A) (#2)	
	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU
Bethesda CBD(#7)	9,833	850					9,246	1,865	(587)	1,015
Bethesda/Chevy Chase(#7)	1,341	707					11,100	4,240	9,759	3,533
Bethesda	11,174	1,557	16,346	4,105	5,172	2,548				
Cloverly(#8)	82	821	591	(468)	509	(1,289)	341	1,782	259	961
Damascus(#9)	246	535	854	(129)	608	(664)	854	(129)	608	(664)
Fairland/White Oak(#10)	10,006	5,295	5,286	4,240	(4,720)	(1,055)	1,786	2,740	(8,220)	(2,555)
Gaithersburg East	17,548	7,564	14,937	9,545	(2,611)	1,981	14,937	9,545	(2,611)	1,981
Gaithersburg West	20,590	4,222	21,307	7,240	717	3,018	23,307	10,240	2,717	6,018
Germantown East	5,167	2,048	3,996	678	(1,171)	(1,370)	6,746	2,678	1,579	630
Germantown West	7,935	5,081	6,965	3,124	(970)	(1,957)	7,465	3,624	(470)	(1,457)
Kensington/Wheaton(#8)	2,554	4,875	11,184	5,710	8,630	835	7,184	7,710	4,630	2,835
North Bethesda	9,539	2,593	8,916	2,421	(623)	(172)	18,416	6,921	8,877	4,328
Olney	698	2,922	1,113	3,313	415	391	2,613	5,313	1,915	2,391
Potomac(#11)	428	2,336	3,295	4,493	2,867	2,157	3,295	4,493	2,867	2,157
Rockville(#12)	14,000	850					20,325	2,753	6,325	1,903
Silver Spring CBD(#13)	4,085	383	14,835	3,383	10,750	3,000	14,835	3,383	10,750	3,000
Silver Spring/Takoma Park(#13)	880	207	1,380	824	500	617	1,380	824	500	617
TOTAL CAPACITY FOR NEW SUBDIVISIONS	104,932	41,289	126,330	50,829	31,493	15,450	143,830	68,111	50,199	31,369

[1]The ceilings indicate the amount of jobs or housing units by which the road capacity in the augmented A FY 89-94 CIP or FY 88-93 CTP exceed the estimated level of development as of January 1, 1987. Negative numbers, shown in parentheses, indicate the amount by which the estimated level of development exceeds the augmented A FY 89 ceiling.

[2]Capacity remaining after the pipeline is subtracted from the ceilings derived from road capacity in the augmented A FY 89-94 CIP or the FY 88-93 CTP shown in the previous column.

[3-13]These footnotes are the same as those shown on the Anticipated FY 89 Ceiling Table.

TABLE 3.3

FY 89 Augmented "B"

POLICY AREA(#3)	A: Pipeline of Approved Subdivions (As of 10/8/87) (Base=1987) (#4) JOBS	A: HU	B: Ceiling Adopted for Use in FY 88 (Based on FY 88 AGP) (Base=1987) (#5) JOBS	B: HU	C: Remaining Capacity Under FY 88 AGP (As of 10/8/87) (Base=1987) (B-A) (#6) JOBS	C: HU	H: Proposed FY 89 AGP Ceiling Based on 5th Year of FY 88-93 CIP Plus Augmented "B" (#1) JOBS	H: HU	I: Proposed FY 89 AGP Remaining Capacity Based on 5th Year of FY 88-93 CIP Plus Augmented "B" (H-A) (#2) JOBS	I: HU
Bethesda CBD(#7)	9,833	850					9,246	1,865	(587)	1,015
Bethesda/Chevy Chase(#7)	1,341	707					11,100	4,240	9,759	3,533
Bethesda	11,174	1,557	16,346	4,105	5,172	2,548				
Cloverly(#8)	82	821	591	(468)	509	(1,289)	341	1,782	259	961
Damascus(#9)	246	535	854	(129)	608	(664)	854	(129)	608	(664)
Fairland/White Oak(#10)	10,006	5,295	5,286	4,240	(4,720)	(1,055)	1,786	2,740	(8,220)	(2,555)
Gaithersburg East	17,548	7,564	14,937	9,545	(2,611)	1,981	14,937	9,545	(2,611)	1,981
Gaithersburg West	20,590	4,222	21,307	7,240	717	3,018	23,307	10,240	2,717	6,018
Germantown East	5,167	2,048	3,996	678	(1,171)	(1,370)	10,746	5,678	5,579	3,630
Germantown West	7,935	5,081	6,965	3,124	(970)	(1,957)	8,965	3,624	1,030	(1,457)
Kensington/Wheaton(#8)	2,554	4,875	11,184	5,710	8,630	835	7,184	7,710	4,630	2,835
North Bethesda	9,539	2,593	8,916	2,421	(623)	(172)	18,416	6,921	8,877	4,328
Olney	698	2,922	1,113	3,313	415	391	2,613	5,313	1,915	2,391
Potomac(#11)	428	2,336	3,295	4,493	2,867	2,157	3,295	4,493	2,867	2,157
Rockville(#12)	14,000	850					20,325	2,753	6,325	1,903
Silver Spring CBD(#13)	4,085	383	14,835	3,383	10,750	3,000	14,835	3,383	10,750	3,000
Silver Spring/Takoma Park(#13)	880	207	1,380	824	500	617	1,380	824	500	617
TOTAL CAPACITY FOR NEW SUBDIVISIONS	104,932	41,289	126,330	50,829	31,493	15,450	149,330	71,111	55,229	34,369

[1]The ceilings indicate the amount of jobs or housing units by which the road capacity in the augmented B FY 89-94 CIP or FY 88-93 CTP exceed the estimated level of development as of January 1, 1987. Negative numbers, shown in parentheses, indicate the amount by which the estimated level of development exceeds the augmented B FY 89 ceiling.

[2]Capacity remaining after the pipeline is subtracted from the ceilings derived from road capacity in the augmented B FY 89-94 CIP or the FY 88-93 CTP shown in the previous column.

[3-13]These footnotes are the same as shown on the Anticipated FY 89 Ceiling Table.

TABLE 3.4

Revised Test at Subdivision Ceilings for FY 88

POLICY AREA(#3)	A: Pipeline of Approved Subdivions (As of 10/8/87) (Base=1987) (#4)		B: Ceiling Adopted for Use in FY 88 (Based on FY 88 AGP) (Base=1987) (#5)		C: Remaining Capacity Under FY 88 AGP (As of 10/8/87) (Base=1987) (B-A) (#6)		J: Ceiling for Use with Revised Test at Subdivision Ceilings for FY 88 (#1)		K: Remaining Capacity Under Revised Test at Subdivision Ceilings for FY 88 (J-A) (#2)	
	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU
Bethesda CBD(#7)	9,833	850								
Bethesda/Chevy Chase(#7)	1,341	707								
Bethesda	11,174	1,557	16,346	4,105	5,172	2,548	20,346	6,105	9,172	4,548
Cloverly(#8)	82	821	591	(468)	509	(1,289)	341	(218)	259	(1,039)
Damascus(#9)	246	535	854	(129)	608	(664)	854	(129)	608	(664)
Fairland/White Oak(#10)	10,006	5,295	5,286	4,240	(4,720)	(1,055)	9,786	3,240	(220)	(2,055)
Gaithersburg East	17,548	7,564	14,937	9,545	(2,611)	1,981	25,937	16,545	8,389	8,981
Gaithersburg West	20,590	4,222	21,307	7,240	717	3,018	25,307	14,240	4,717	10,018
Germantown East	5,167	2,048	3,996	678	(1,171)	(1,370)	7,246	3,178	2,079	1,130
Germantown West	7,935	5,081	6,965	3,124	(970)	(1,957)	7,715	4,124	(220)	(957)
Kensington/Wheaton(#8)	2,554	4,875	11,184	5,710	8,630	835	7,184	7,710	4,630	2,835
North Bethesda	9,539	2,593	8,916	2,421	(623)	(172)	12,666	4,671	3,127	2,078
Olney	698	2,922	1,113	3,313	415	391	3,113	6,063	2,415	3,141
Potomac(#11)	428	2,336	3,295	4,493	2,867	2,157	3,295	4,493	2,867	2,157
Rockville(#12)	14,000	850					15,325	1,753	1,325	903
Silver Spring CBD(#13)	4,085	383	14,835	3,383	10,750	3,000	14,835	3,383	10,750	3,000
Silver Spring/Takoma Park(#13)	880	207	1,380	824	500	617	1,380	824	500	617
TOTAL CAPACITY FOR NEW SUBDIVISIONS	104,932	41,289	126,330	50,829	31,493	15,450	155,330	76,329	50,838	39,408

[1]The ceilings indicate the amount of jobs or housing units by which the road capacity in the RTAS FY 88-93 CIP or FY 87-92 CTP exceed the estimated level of development as of January 1, 1987. Negative numbers, shown in parentheses, indicate the amount by which the estimated level of development exceeds the RTAS FY 88 ceiling.

[2]Capacity remaining after the pipeline is subtracted from the ceilings derived from road capacity in the RTAS FY 88-93 or the FY 87-92 CTP shown in the previous column.

[3-13]These footnotes are the same as shown on the Anticipated FY 89 Ceiling Table.

TABLE 3.5

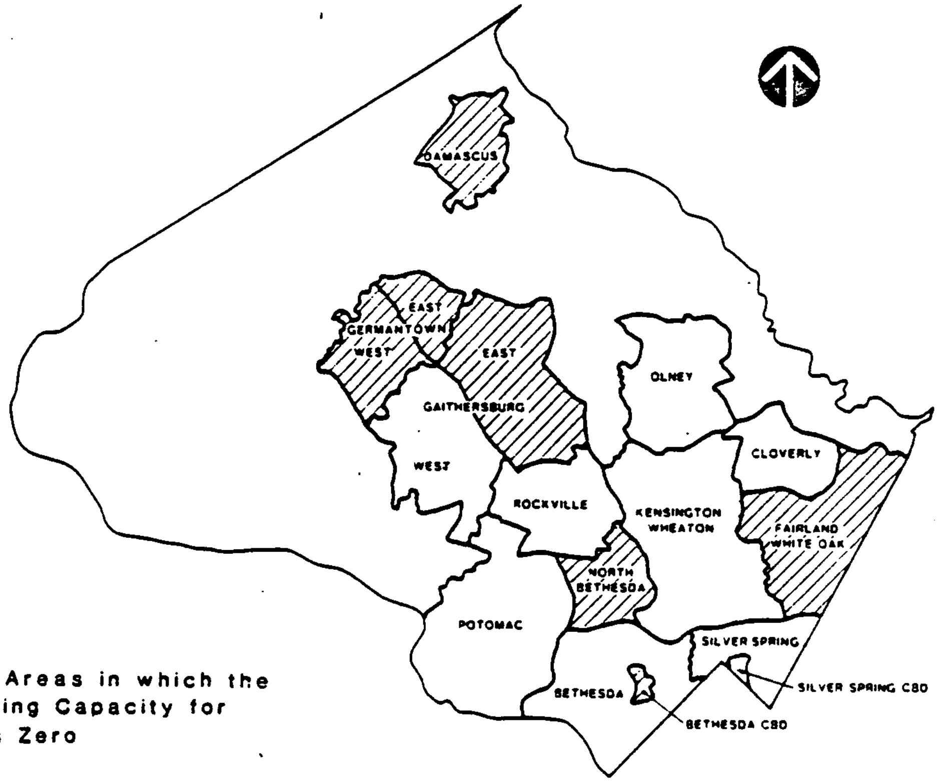
Revised Test at Subdivision Ceilings for FY 89

POLICY AREA(#3)	A: Pipeline of Approved Subdivions (As of 10/8/87) (Base=1987) (#4)		B: Ceiling Adopted for Use in FY 88 (Based on FY 88 AGP) (Base=1987) (#5)		C: Remaining Capacity Under FY 88 AGP (As of 10/8/87) (Base=1987) (B-A) (#6)		L: Ceiling for Use with Revised Test at Subdivision Ceilings for FY 89 (#1)		M: Remaining Capacity Under Revised Test at Subdivision Ceilings for FY 89 (L-A) (#2)	
	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU	JOBS	HU
Bethesda CBD(#7)	9,833	850					9,246	1,865	(587)	1,015
Bethesda/Chevy Chase(#)	1,341	707					11,100	4,240	9,759	3,533
Bethesda	11,174	1,557	16,346	4,105	5,172	2,548				
Cloverly(#8)	82	821	591	(468)	509	(1,289)*	341	(218)	259	(1,039)*
Damascus(#9)	246	535	854	(129)	608	(664)*	854	(129)	608	(664)*
Fairland/White Oak(#10	10,006	5,295	5,286	4,240	(4,720)	(1,055)*	9,786	3,990	(220)	(1,305)*
Gaithersburg East	17,548	7,564	14,937	9,545	(2,611)	1,981	25,937	16,545	8,389	8,981
Gaithersburg West	20,590	4,222	21,307	7,240	717	3,018	25,807	15,240	5,217	11,018
Germantown East	5,167	2,048	3,996	678	(1,171)	(1,370)*	10,496	6,678	5,329	4,630
Germantown West	7,935	5,081	6,965	3,124	(970)	(1,957)*	9,965	4,124	2,030	(957)*
Kensington/Wheaton(#8)	2,554	4,875	11,184	5,710	8,630	835	7,184	7,710	4,630	2,835
North Bethesda	9,539	2,593	8,916	2,421	(623)	(172)*	15,666	5,921	6,127	3,328
Olney	698	2,922	1,113	3,313	415	391	3,113	6,063	2,415	3,141
Potomac(#11)	428	2,336	3,295	4,493	2,867	2,157	3,295	4,493	2,867	2,157
Rockville(#12)	14,000	850					20,325	2,753	6,325	1,903
Silver Spring CBD(#13)	4,085	383	14,835	3,383	10,750	3,000	14,835	3,383	10,750	3,000
Silver Spring/Takoma Prk(#13)	880	207	1,380	824	500	617	1,380	824	500	617
TOTAL CAPACITY FOR NEW SUBDIVISIONS	104,932	41,289	126,330	50,829	31,493	15,450	169,330	83,829	64,618	46,158

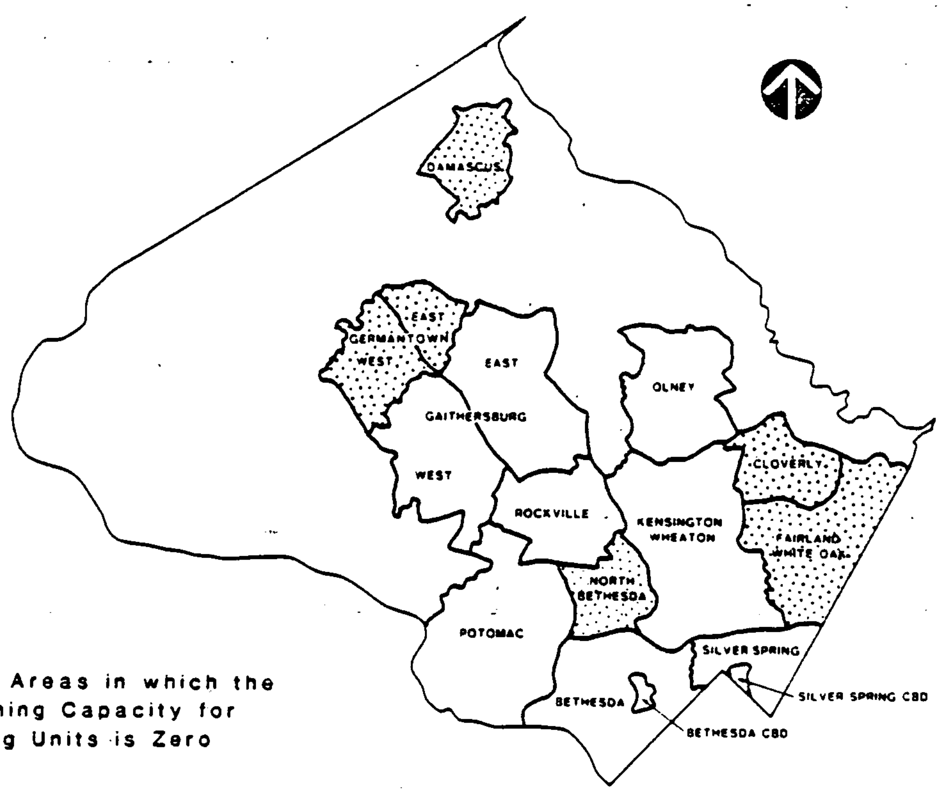
[1]The ceilings indicate the amount of jobs or housing units by which the road capac in the RTAS FY 89-94 CIP or FY 88-93 CTP exceed the estimated level of development of January 1, 1987. Negative numbers, shown in parentheses, indicate the amount b which the estimated level of development exceeds the RTAS FY 89 ceiling.

[2]Capacity remaining after the pipeline is subtracted from the ceilings derived fro road capacity in the RTAS FY 89-94 or the FY 88-93 CTP shown in the previous colum

[3-13]These footnotes are the same as shown on the Anticipated FY 89 Ceiling Table.



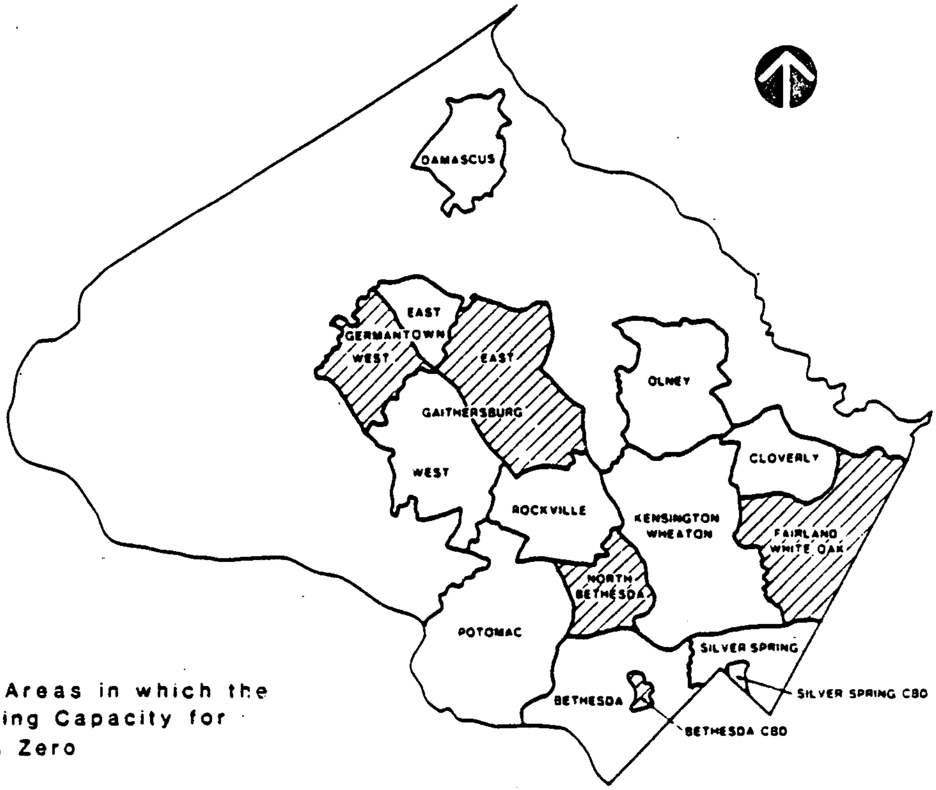
Policy Areas in which the Remaining Capacity for Jobs is Zero



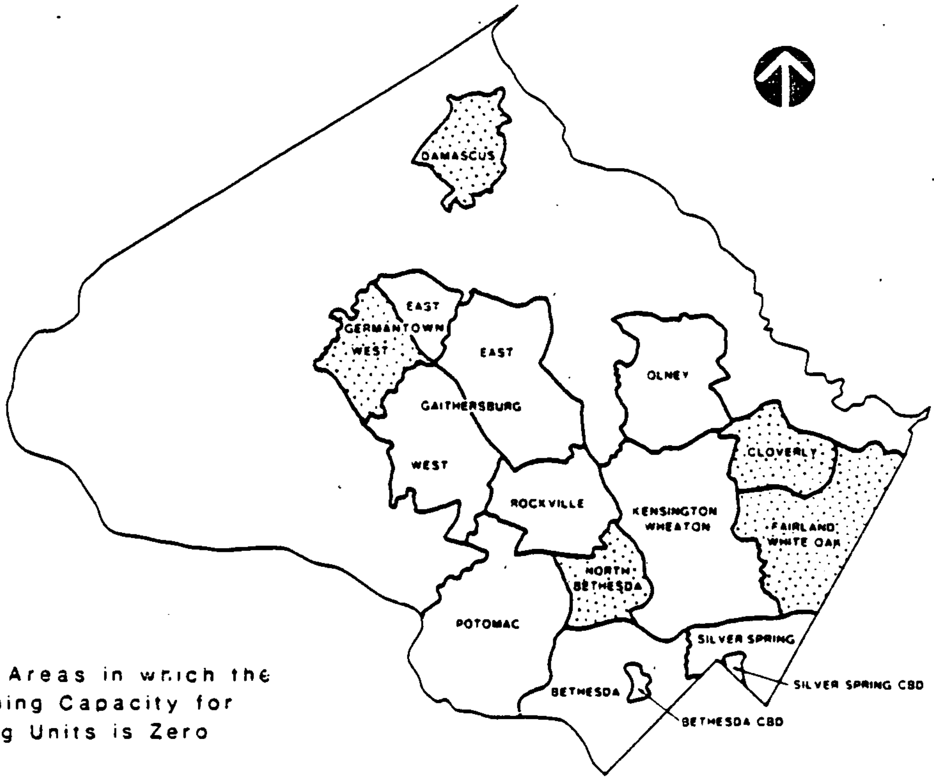
Policy Areas in which the Remaining Capacity for Housing Units is Zero

MAP 3.1

FY 88 Annual Growth Policy Remaining Staging Ceiling Capacity



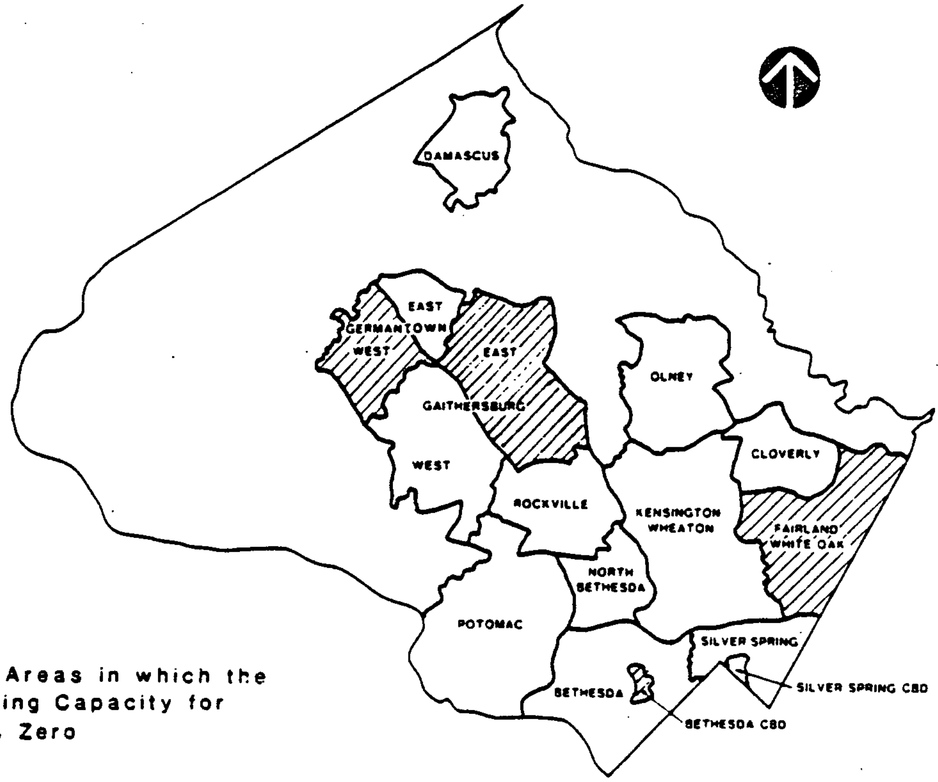
Policy Areas in which the Remaining Capacity for Jobs is Zero



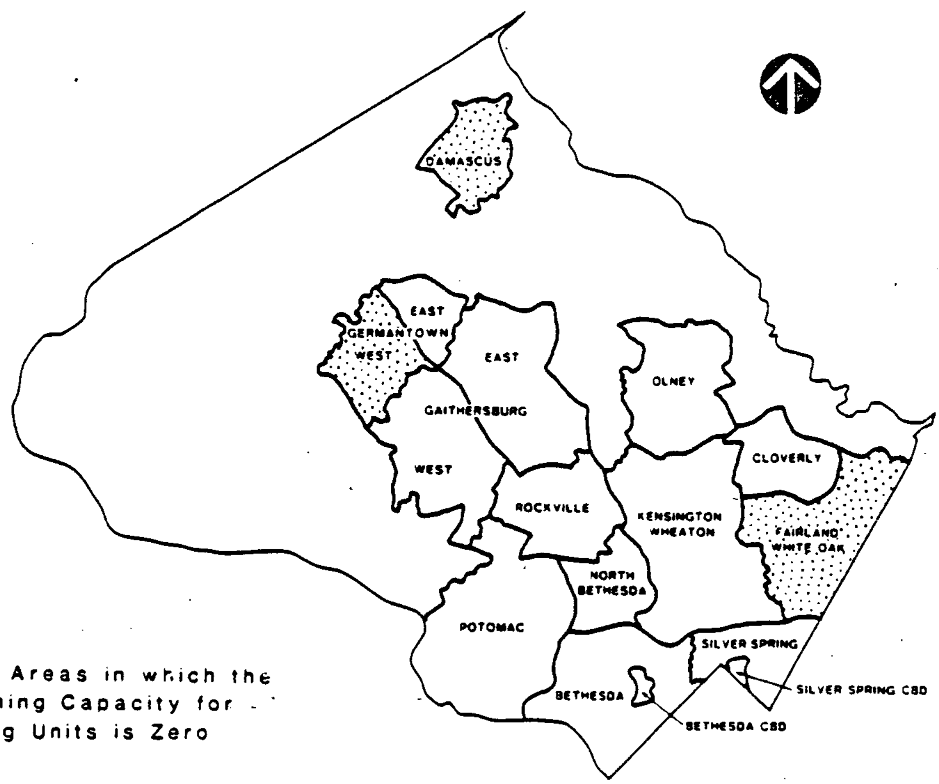
Policy Areas in which the Remaining Capacity for Housing Units is Zero

MAP 3.2

FY 89 Anticipated Annual Growth Policy Remaining Staging Ceiling Capacity



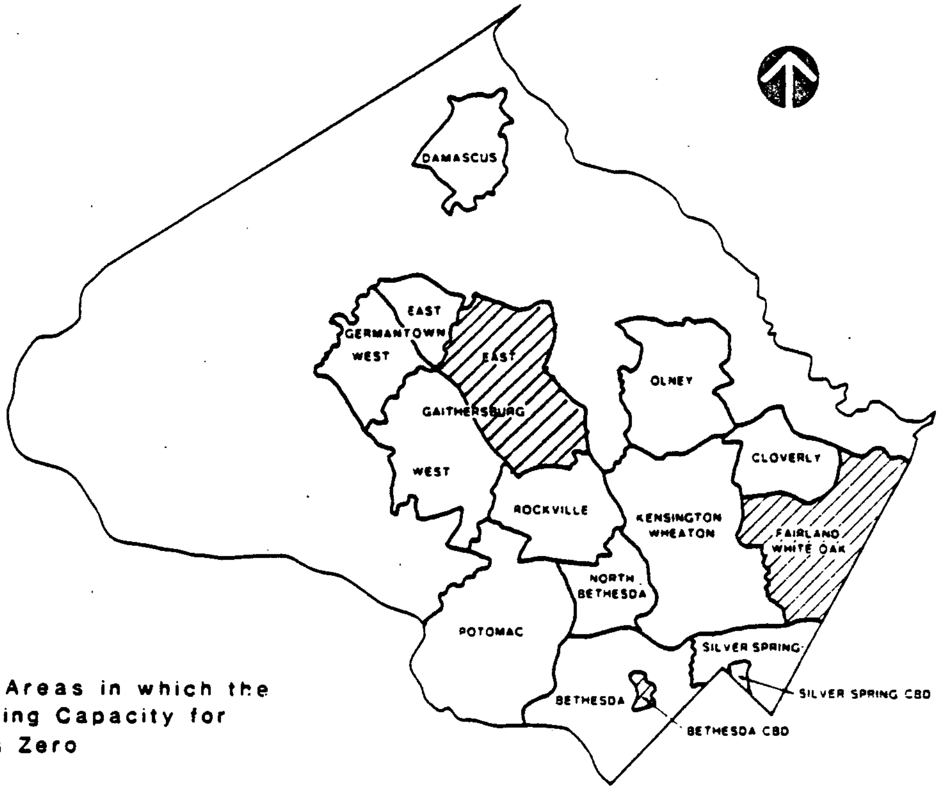
Policy Areas in which the Remaining Capacity for Jobs is Zero



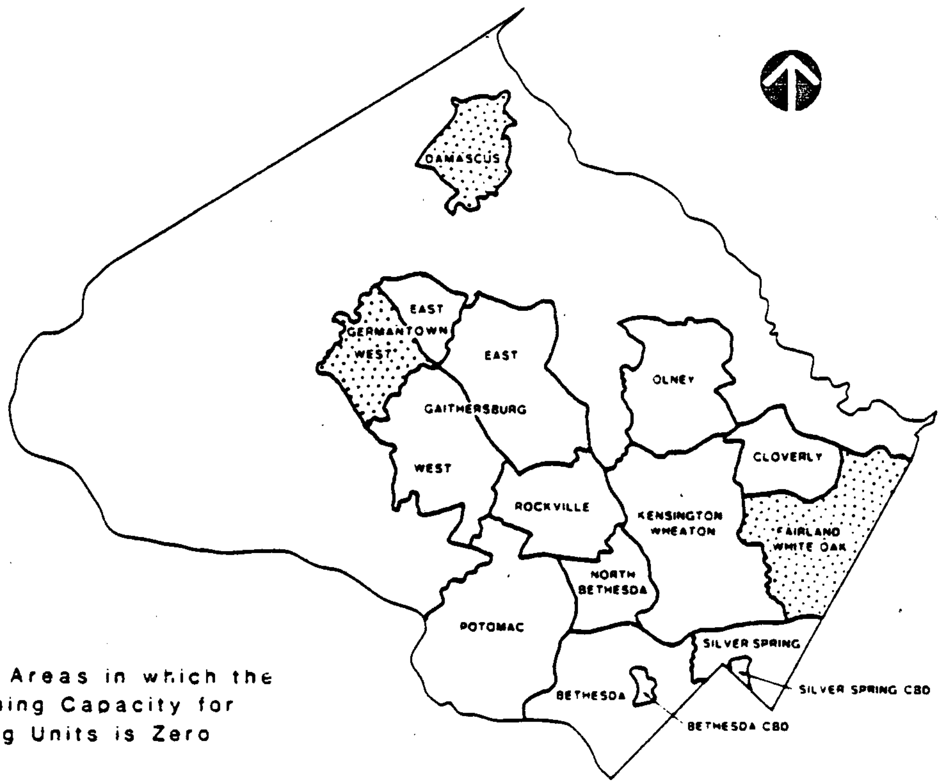
Policy Areas in which the Remaining Capacity for Housing Units is Zero

MAP 3.3

FY 89 Low Augmented Annual Growth Policy Remaining Staging Ceiling Capacity



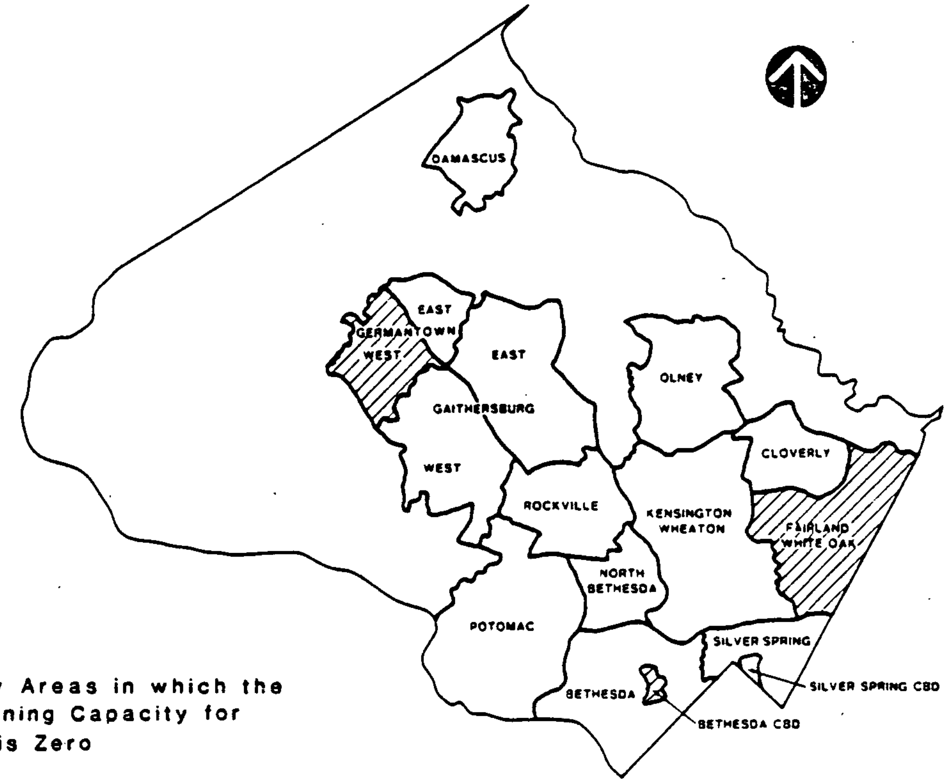
Policy Areas in which the Remaining Capacity for Jobs is Zero



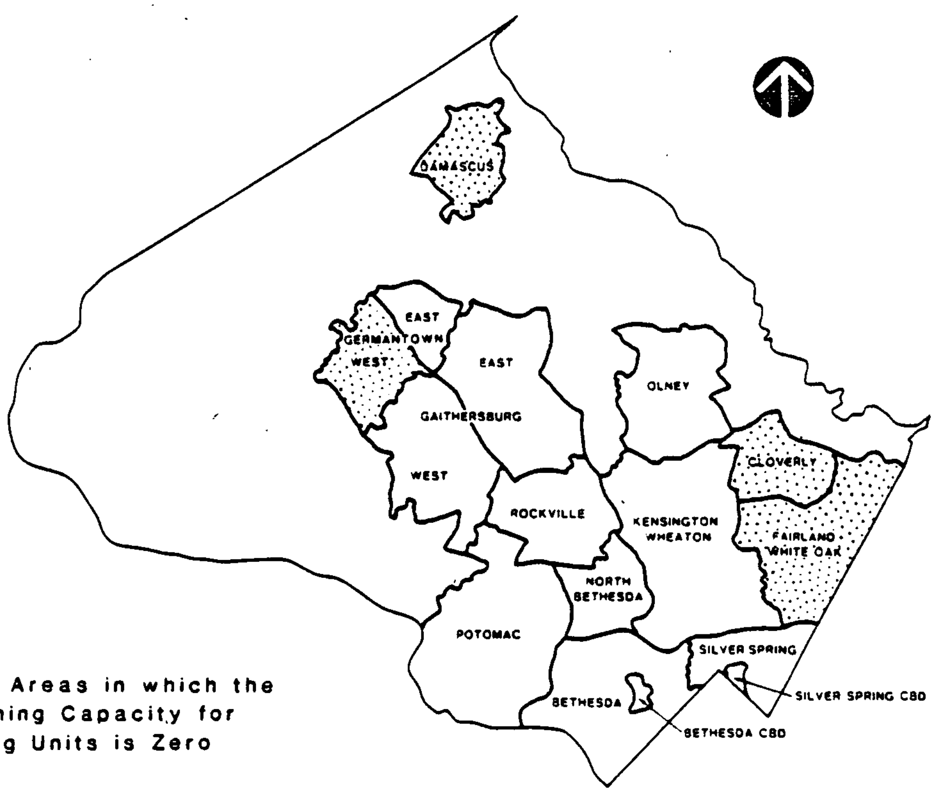
Policy Areas in which the Remaining Capacity for Housing Units is Zero

MAP 3.4

FY 89 High Augmented Annual Growth Policy Remaining Staging Ceiling Capacity



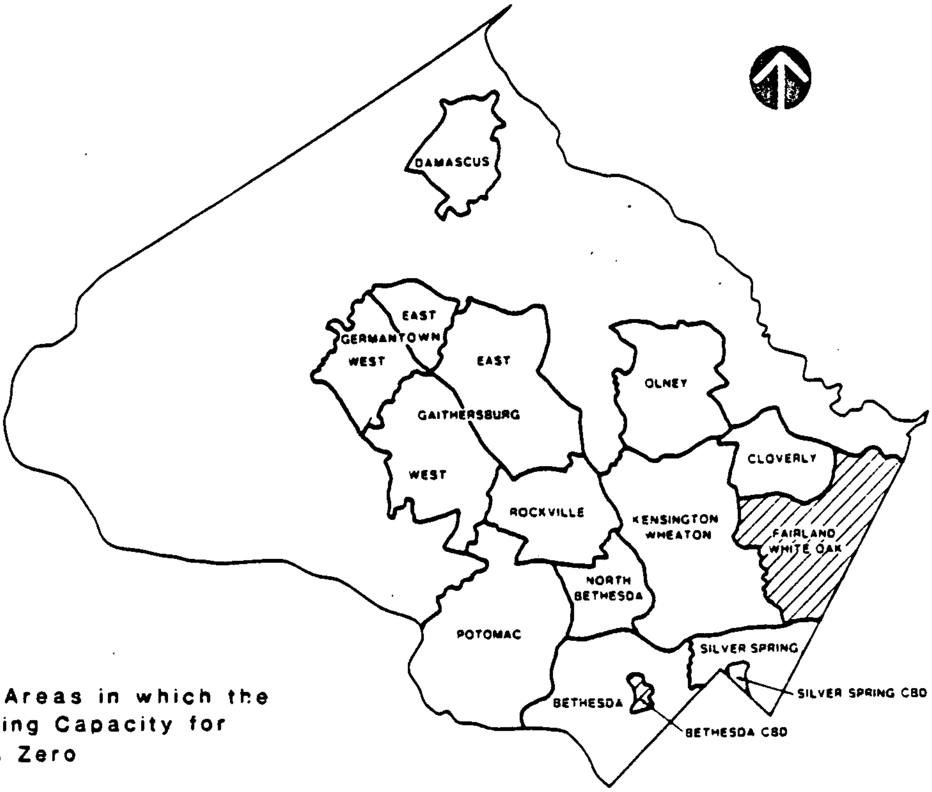
Policy Areas in which the Remaining Capacity for Jobs is Zero



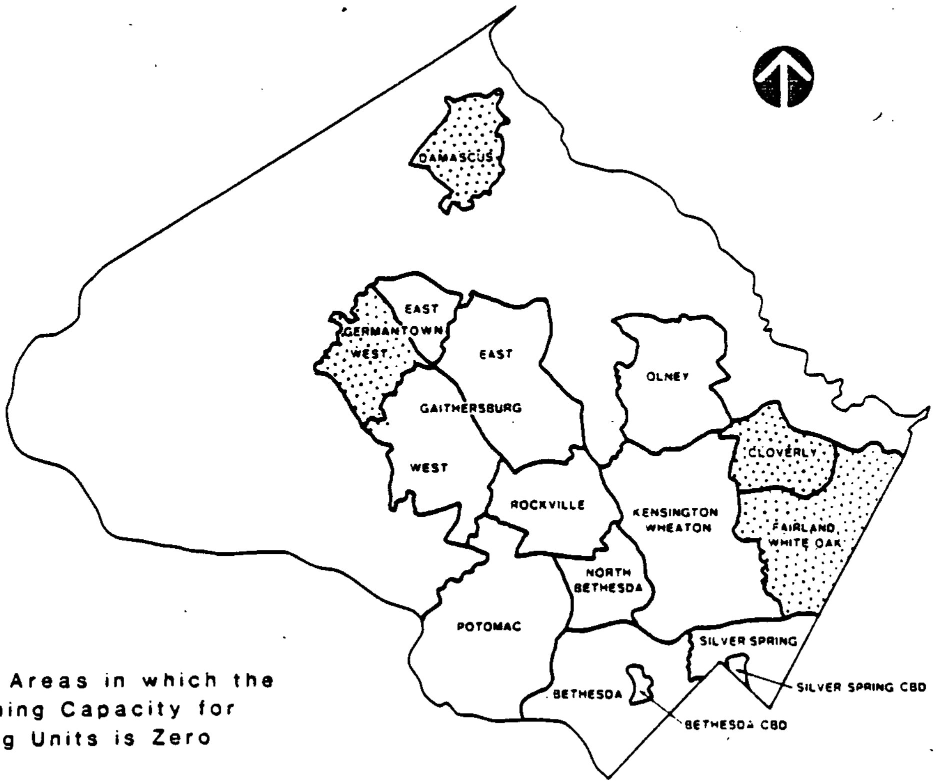
Policy Areas in which the Remaining Capacity for Housing Units is Zero

MAP 3.5

FY 88 Revised Test AT Subdivision Remaining Staging Ceiling Capacity



Policy Areas in which the Remaining Capacity for Jobs is Zero



Policy Areas in which the Remaining Capacity for Housing Units is Zero

MAP 3.6

FY 89 Revised Test AT Subdivision Remaining Staging Ceiling Capacity

B. GENERAL DESCRIPTION OF POLICY AREA NARRATIVES:

The following section of this chapter contains a narrative description for each policy area that relates the numbers in Tables 2.1 through 2.5 to the local situation in each policy area. The narrative for each area discusses four main items: (1) current transportation conditions, (2) programmed transportation improvements, (3) adopted staging ceilings relative to the pipeline and (4) alternative transportation improvements and staging ceilings. This last part of each narrative discusses the specific alternative transportation improvements which make up the five Staging Ceiling Scenarios. In addition, there is discussion for each area of potential future improvements that could be included in later years of the CIP and CTP as well as discussion of potential mid-term traffic alleviation measures. The following discussion briefly describes how to read and interpret each of the staging charts which accompanies the narrative for each of the policy areas.

C. GENERAL DESCRIPTION OF POLICY AREA STAGING CHARTS:

Each of the transportation policy areas which have staging ceilings also have accompanying Staging Charts. The charts show the forecast ranges and approved subdivisions (pipeline) in relation to the adopted FY 88 staging ceilings and alternative FY 89 staging ceilings. There are two charts for each area; one for jobs and one for housing units.

The vertical axis shows totals for each respective measure. The horizontal axis represents time. The heaviest line represents actual growth between 1980 and 1987. After 1987 it shows the intermediate (most probable) forecast. The lighter lines originating at the 1987 point are the high and low forecasts. The current pipeline, staging ceilings, and the anticipated FY 89 staging ceilings are represented by horizontal lines. Where applicable, points are also shown to reflect ceilings for FY 89 Augmented A & B as well as RTAS FY 88 and RTAS FY 89. The year in which the pipeline and staging ceilings may actually become development on the ground can be estimated by seeing where they cross the forecast lines, and then referring down to the horizontal time axis.

BETHESDA

Current Transportation Conditions

Transit Availability: This area is served by regional bus service, Ride-On community bus service, and Metro at the Friendship Heights, and Medical Center stations. With the opening of the Metrorail Line to Shady Grove, the bus services were restructured to focus on the rail stations as destinations. A high proportion of the bus routes provide better than 30 minute frequency.

Level of Service Conditions: An estimate of the average LOS is that it is currently better than the average LOS D/E set as the standard for this area. There are many local intersections in the Bethesda area which are operating at or approaching Level of Service E. Such conditions are found along Old Georgetown Road, Wisconsin Avenue, Connecticut Avenue, East-West Highway and at places on River Road, Bradley Boulevard, and Wilson Lane.

Programmed Transportation Improvements

There are several programmed projects in this area included in the Adopted FY 88-93 CIP: 1) Woodmont Avenue extended to the south, and 2) the Hills Plaza connection. In the State CTP is the widening of I-495 (the Capital Beltway) from Wisconsin Avenue (MD 355) to Georgia Avenue (MD 97). An improvement which will provide some benefit to transit is the pedestrian underpass of Wisconsin Avenue (MD 355) at the Bethesda Metro station. The FY 88-93 CIP also includes a project for Metro station bicycle parking which may serve one or more of the Bethesda Policy Area stations when the four test locations are selected. MCDOT has taken on the direct responsibility for the operation of the Bethesda Share-A-Ride program and has programmed an expansion of service as one of the approved traffic alleviation measures. Another of the approved measures is a study of bus priority treatments in the vicinity of the Bethesda Metro station.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceilings provide for 5,172 net available jobs above the pipeline and 2,548 net available housing units above the pipeline. The two sector plans within this policy area provide specific guidance on the allocation within the area of that net available capacity for new subdivisions. The Friendship Heights Sector Plan limits development within that area in absolute terms on a parcel-by-parcel basis. It does not recommend staging ceiling limits, and thus the staging ceilings do not change the amount or timing of development in Friendship Heights. The staging ceilings for the Bethesda Policy Area do not allow more growth than the recommendations in the Bethesda CBD Sector Plan. Therefore, in the Bethesda CBD Sector Plan portion of the Bethesda Policy Area, local area transportation reviews will not be required but development must be in accordance with the available trip allocations for the particular type of development (optional, standard, or residential). Consideration is being given to separate the Bethesda CBD from Bethesda/Chevy Chase as a separate policy area. The staging ceiling tables discussed earlier in this chapter show staging ceilings for both Bethesda CBD and Bethesda/Chevy Chase.

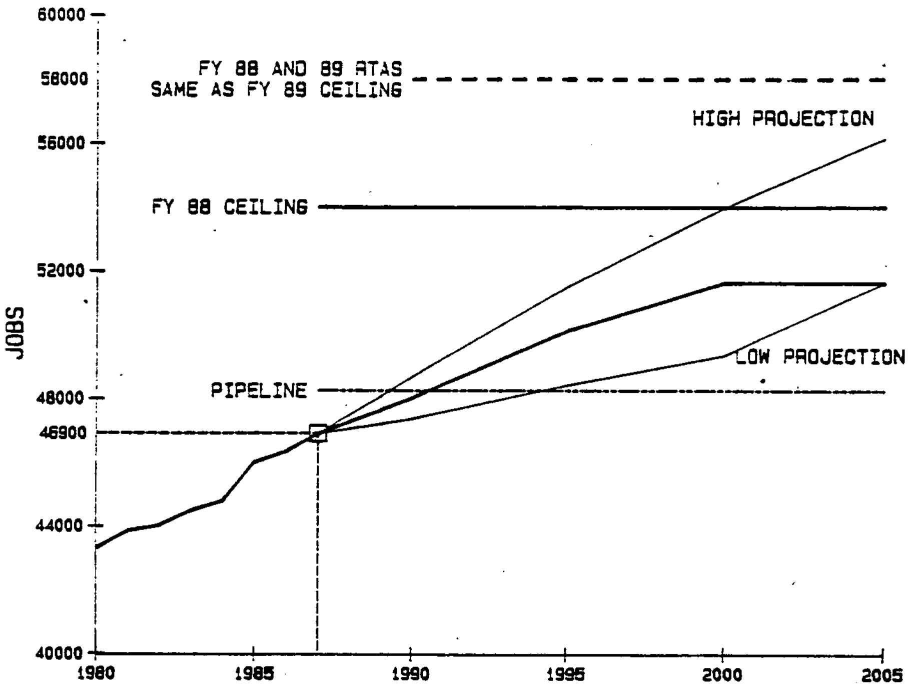
Alternative Transportation Improvements and Staging Ceilings

It is anticipated that the state's CTP will advance the widening of I-495 (the Capital Beltway) between the American Legion Bridge to north of River Road so that it will be 100% funded by FY 92. This project increases the staging ceilings in the anticipated FY 89 AGP.

Longer range projects such as the use of the Georgetown Branch right-of-way as an east-west transitway and the Friendship Boulevard extension will not progress to the point where they could be considered for staging ceilings at this time.

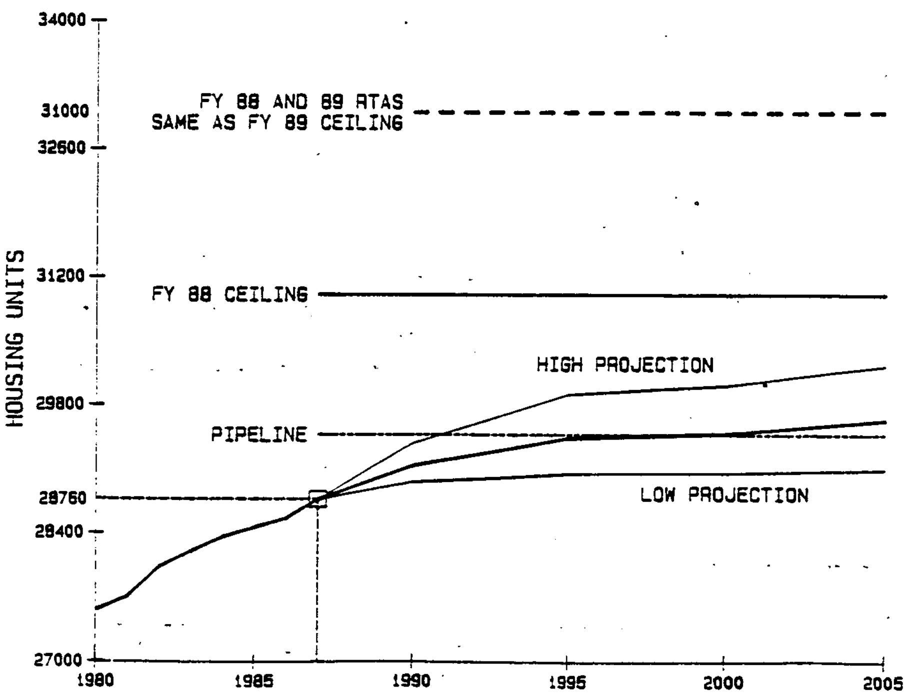
BETHESDA/CHEVY CHASE

JOBS



PIPELINE IS BUILT OUT BY 1990,2 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1998, 10 YEARS

CLOVERLY

Current Transportation Conditions

Transit Availability: Transit service in the Cloverly area is provided along New Hampshire Avenue and along parts of Briggs Chaney Road and Good Hope Road.

Level of Service Conditions: The estimate of the present average LOS is that it is currently more congested than the average LOS C set as the standard for this area. The critical roadway segment for this policy area is MD 650 (New Hampshire Avenue). This roadway is congested in the adjacent White Oak-Colesville Policy Area. North of the Colesville Shopping Center at Randolph Road, New Hampshire Avenue is only two-lanes wide and the intersection operates at a Level of Service E. The southbound approach on New Hampshire Avenue to the Good Hope Road and Bonifant Road intersection operates at LOS F condition in the morning. The 1985 average annual weekday traffic between Randolph Road and Notley Road was 31,900 vehicles, and 24,700 vehicles between Notley Road and Good Hope Road.

Programmed Transportation Improvements

There are three programmed projects which serve the Cloverly area: (1) Bonifant Road safety and realignment project, (2) the Ednor Road Bridge widening over the north branch, and (3) the MD 28/MD 198 Connector project between Layhill Road (MD 182) and New Hampshire Avenue (MD 650). This last project is also listed in the adopted CTP as Maryland 28 extended, but without any funding indicated.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceiling provides for just over 500 net available jobs above the pipeline while the pipeline exceeds the housing staging ceiling resulting in zero net available housing units. A technical adjustment to the Adopted Staging Ceiling is proposed to better account for zoning ceiling for jobs. Consequently, a shift of reducing the jobs ceiling by 250 and increasing the housing units ceiling by 250 has been included.

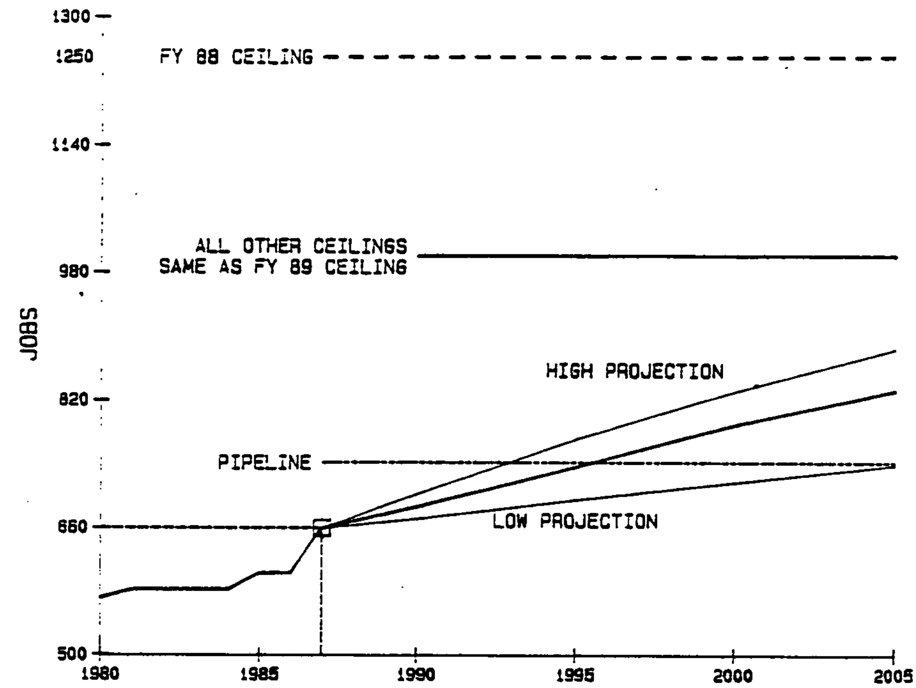
Alternative Transportation Improvements and Staging Ceilings

At this time, there are no projects that will be advanced to the point where they could be used to increase the anticipated FY 89 AGP.

There are some potential future projects which can serve this area. The SHA is conducting a Project Planning Study for the reconstruction and widening of New Hampshire Avenue (MD 650) from Randolph Road to MD 198 (Spencerville Road). A separate analysis of the Anticipated Fourth Year Transportation Projects, augmented with the addition of the New Hampshire Avenue (MD 650) widening, is being developed. The realignment of Briggs Chaney Road to Norwood Road at New Hampshire Avenue could be done either as a project by MCDOT or as part of the SHA New Hampshire project. Under the alternatives that consider augmenting the FY 89 AGP, the staging ceilings would be increased to the extent that these could be a positive net available ceiling for having units.

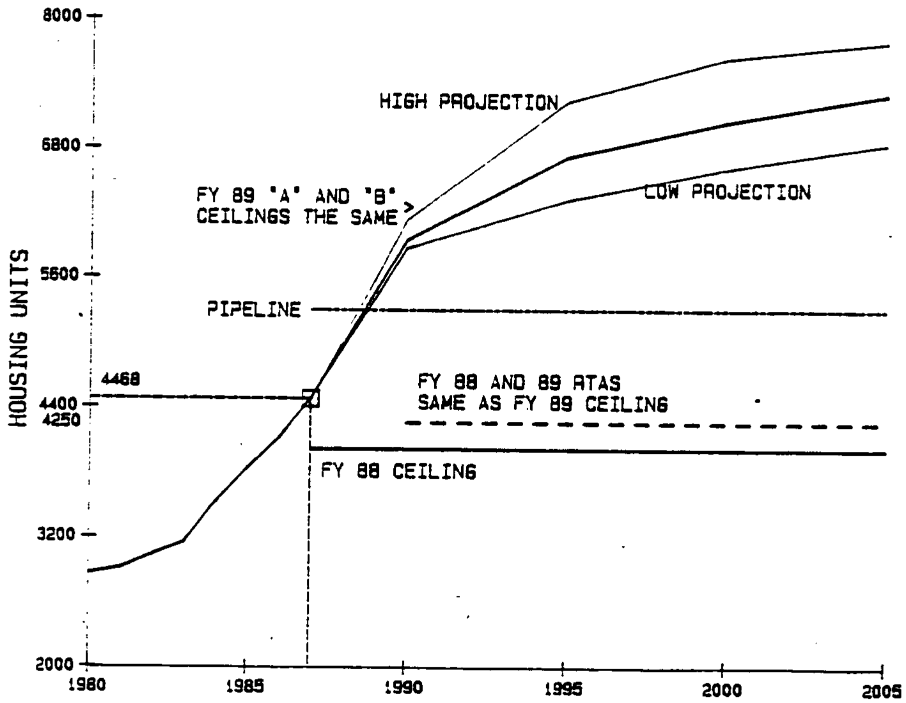
CLOVERLY

JOBS



PIPELINE IS BUILT OUT BY 1995, 7 YEARS

HOUSING



PIPELINE WAS BUILT OUT BY 1988

DAMASCUS

Current Transportation Conditions

Transit Availability: MCDOT has instituted experimental bus service from Damascus to the Shady Grove Metro station during peak traffic periods.

Level of Service Conditions: The estimate of the current average LOS is that it is the same as the average LOS C set as the standard for this area. The intersection of Main Street (MD 27) and (MD 108) operates at Level of Service F. Ridge Road (MD 27) south of Damascus to Frederick Road (MD 355) carries an average annual weekday volume of 14,900 vehicles north of Brink Road. The traffic volumes north of the center of Damascus are also high, about 18,350 vehicles per day due in large part to significant external traffic from Frederick and Carroll Counties.

Programmed Transportation Improvements

The Lewis Drive connector is programmed in the adopted CIP and geometric improvements along Ridge Road (MD 27) between the two intersections with the Lewis Drive connector are programmed by MCDOT. They have been used in the staging ceiling analysis for Damascus. Sweepstakes Road is programmed by MCDOT for improvement to primary residential standard between MD 27 and MD 124. Since the Lewis Drive connector and the Ridge Road (MD 27) improvement are in the approved road program, the intersection of Main Street (MD 103) and Ridge Road (MD 27) will operate at an acceptable LOS.

Adopted Staging Ceilings Relative to the Pipeline

Staging ceilings of zero for both jobs and housing units were first established for this area in the 1985 CPP Report. The FY 88 AGP also showed zero remaining ceiling for both jobs and housing units. During our review of pipeline of jobs in Damascus it was determined that the pipeline previously used for Damascus include all approved development in Clarksburg, Goshen, Patuxent, and Poolesville. With the correction of this accounting error, the remaining ceiling for job is actually a positive 608 in the FY 88 AGP.

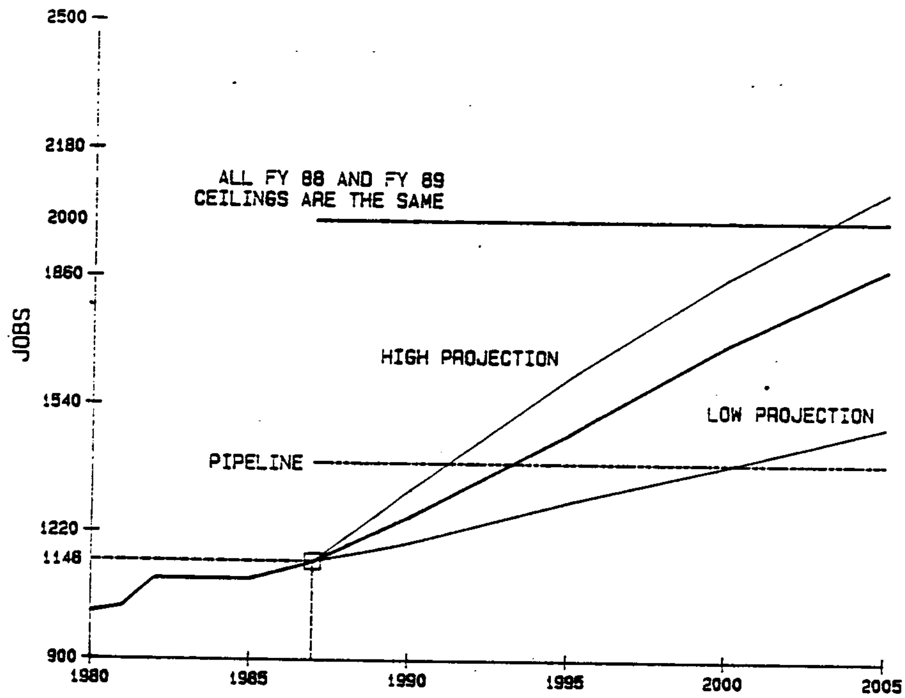
Alternative Transportation Improvements and Staging Ceilings

There were no roadway improvements within Damascus that could be expected to be programmed in the forthcoming CIP or CTP that would increase the staging ceiling under any of the alternatives considered. The MD 124 Extension project has not yet been accounted for because it is currently scheduled for the sixth year of the adopted CIP and thus not among the Anticipated FY 89 projects and the conditions to trigger it as a RTAS project are not met. Consequently the staging ceilings would remain the same as the corrected FY 88 Adopted Staging Ceiling.

There are several potential future improvements which could begin to work their way into the latter years of the FY 89-94 CIP or the FY 88-93 CTP. The first project would be the reconstruction of Ridge Road (MD 27) from Damascus to Frederick Road (MD 355), an improvement which will be needed to eliminate link congestion and improve intersection safety along Ridge Road. That project is among the top two on the list of priorities for new project planning studies by MDDOT and a preliminary feasibility study has been initiated by the State Highway Administration. That study will need to carefully consider the effects such a reconstruction would have on existing homes along Ridge Road. A second project would be the widening of MD 124 from Warfield Road to Mid-County Highway. A third project could be the extension of Bethesda Church Road between Ridge Road (MD 27) and Woodfield Road (MD 124).

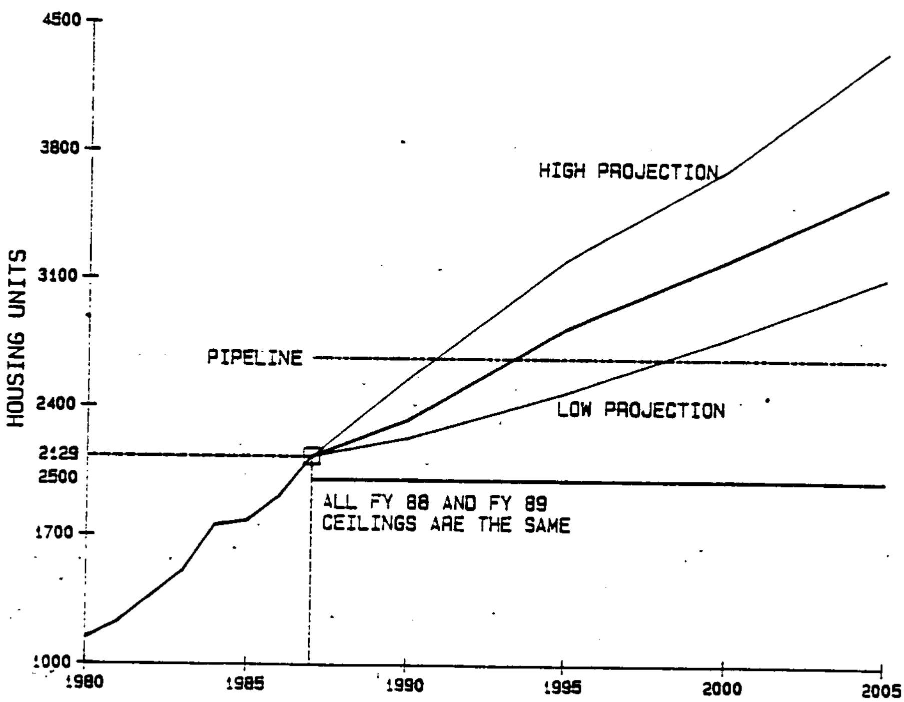
DAMASCUS

JOBS



PIPELINE IS BUILT OUT IN 1993, 5 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1993, 5 YEARS

FAIRLAND/WHITE OAK

Current Transportation Conditions

Transit Availability: The area is currently served by regional bus service along Columbia Pike (US 29), New Hampshire Avenue, across Randolph Road, Fairland Road, Briggs Chaney Road and along Old Columbia Pike. MCDOT Ride-On Community Bus service is available in the West Hillandale area. Ridership on the express service from the Briggs Chaney park-'n'-ride lot continues to be good. Other subdivision approvals have provided for a residential based Share-A-Ride program and a private shuttle bus system to connect that development with the Silver Spring Metro station as well as additional park-'n'-ride parking lots with express bus service to Silver Spring.

Level of Service Conditions: The estimate of the current average LOS is that it is the same as the average LOS C/D which is now being proposed as the standard for this area (see the discussion below). There are several critical roadway segments and intersections in the Fairland/White Oak area. Columbia Pike (US 29) is experiencing low peak-hour levels of service at MD 198, Briggs Chaney Road, Fairland Road, Randolph Road, Industrial Parkway, and Stewart Lane. New Hampshire Avenue (MD 650), in the vicinity of Hillandale, at Lockwood Drive, and at Randolph Road is also heavily congested.

Programmed Transportation Improvements:

There are several programmed projects in the state's CTP and adopted CIP including (1) the widening of US 29 (Columbia Pike) from Industrial Parkway to Randolph Road and from north of Fairland Road to north of Greencastle Road which is part of the adopted CIP and is also listed in the Special Projects Program of the draft CTP, also the CTP includes widening of US 29 from New Hampshire Avenue to Industrial Parkway and between Greencastle Road to north of MD 198 as a special project, (2) East Randolph Road, Phase I and Phase II, (3) Fairland Road safety project and widening at Old Columbia Pike, and (4) a realignment of Briggs Chaney Road in the vicinity of Old Columbia Pike. One of the programmed traffic alleviation measures has already begun with increased bus services in the US 29 Corridor. This past year several additional park and ride lots were programmed, some with the private participation, the net effect of which is to begin providing a system of park and ride lots serving the overall area.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceilings are exceeded by the pipeline resulting in zero net available jobs and housing units for new subdivisions. The adopted ceilings are based upon using an average LOS D associated with Group IV policy areas instead of average LOS C of a Group II which the Fairland White Oak Area had been classified as. That was done for a number of reasons that were discussed in the previous area narratives. The FY 89 AGP is proposing that this area now be classified as a Group III area with an average LOS of C/D. A revised table of correspondence between transit availability and average level of service standards is given in Chapters 5 and 6 of this report. This proposal to have Fairland/White Oak as a Group III with an average LOS of C/D is based upon this revised table and the transit services which are now programmed in the area. The prime feature is that the current services and adopted program provide for moderate frequency of express bus service in conjunction with a system of park and ride lots.

Alternative Transportation Improvements and Staging Ceilings

No new projects will be added this year in the anticipated FY 89 AGP due to some projects previously moving ahead faster than usual in the adoption of the current CIP and CTP

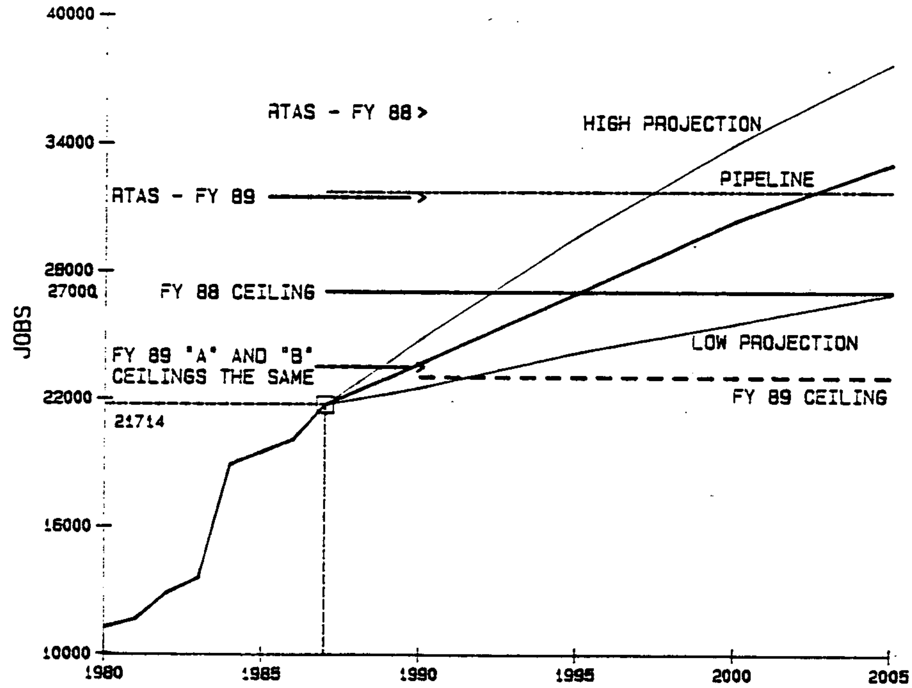
There are some potential future projects which can serve the area. The SHA is conducting a Project Planning Study for the reconstruction and widening of New Hampshire Avenue (MD 650) from Randolph Road to Spencerville Road (MD 198). A separate analysis of the Anticipated Fourth Year Transportation Projects, augmented with the addition of the New Hampshire Avenue (MD 650) widening, is being developed.

The following projects were considered in the RTAS FY 88 alternative: (1) the Intercounty Connector between US 29 and I-95, and (2) Briggs Chaney Road widening from Automobile Boulevard to the Intercounty Connector. The New Hampshire Avenue project listed above is also partially considered in the RTAS FY 89 alternative.

There are two projects that are progressing but will not be sufficiently funded this year. They are; the US 29 improvement study, and the Intercounty Connector east of US 29. While these two additional projects may be shown as having 100% of the construction expenditures in the sixth year of the FY 89-94 CIP or FY 88-93 CTP; they have not been used in ceilings produced for the RTAS FY 89 alternative. These projects were not include because their completion schedule was not considered to be firm and reliable enough.

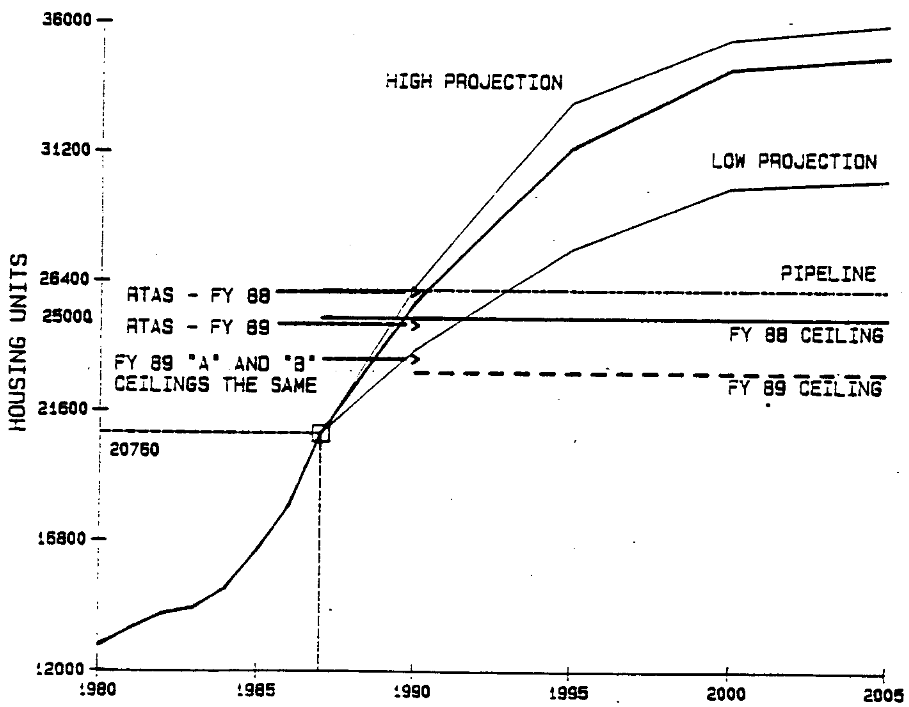
FAIRLAND/WHITE OAK

JOBS



PIPELINE BUILDS OUT AFTER THE YEAR 2000

HOUSING



PIPELINE IS BUILT OUT BY 1990, 2 YEARS

GAITHERSBURG EAST

Current Transportation Conditions

Transit Availability: Gaithersburg East is currently served by private commuter bus, commuter rail, the MCDOT Ride-On bus system, some regional metro bus service and metrorail which opened to Shady Grove in December 1984. An expansion and restructuring of the Metro bus/Ride-On system was implemented in conjunction with the rail opening. An extensive network of Ride-On routes serves the Gaithersburg/Montgomery Village area, with terminal points in the system being at Lake Forest Mall, Shady Grove Metro, and Rockville Metro. A special bus lane has been provided on the shoulder of I-270 during its reconstruction.

Level of Service Conditions: The estimate of the current average LOS is that it is the same as the average LOS C/D set as the standard for this area. There are several intersections in the Gaithersburg East area operating at or approaching LOS E and LOS F. Such conditions can be found along MD 355, Shady Grove Road, the widening of MD 115 relocated at the intersection of (Mid-County Highway) Shady Grove Road and MD 115, at the intersection of MD 115 and MD 124 and on Montgomery Village Avenue and Goshen Road. In addition, there are roadway segments with existing inadequate capacity, such as parts of MD 115.

Programmed Transportation Improvements

The Gaithersburg East area has a large number of transportation improvement projects programmed in the state CTP, the County CIP as well as in the Capital Budget of the City of Gaithersburg. It has the largest number of projects for any of the policy areas in both the list of projects currently being used in the FY 88 AGP and those being considered in the FY 89 AGP scenarios. These transportation improvement projects include the I-270 widening, I-370, Gude Drive and the Railroad Bridge, Airpark Road Extended, Muddy Branch Road, the widening of MD 115 relocated at the intersection of (Mid-County Highway) Shady Grove Road and MD 115/MD 124 Intersection Improvement Project, expansion of Shady Grove Metro Parking, construction of the Watkins Mill Road School access and the Watkins Mill Road Bridge.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceiling provides for 1,981 housing units above the pipeline. For jobs in the Gaithersburg East area, the pipeline now exceeds the adopted staging ceiling, resulting in zero net available jobs.

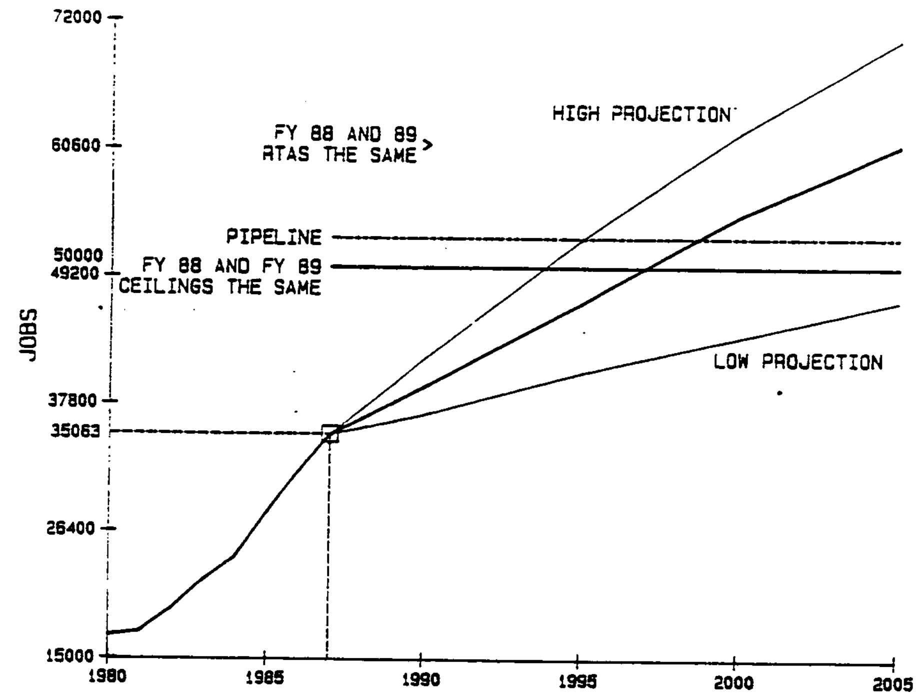
Alternative Transportation Improvements and Staging Ceilings

At this time, it would normally be anticipated that the Germantown/Montgomery Village Connector would move forward to be considered as being a programmed project in the FY 89-94 CIP. However, staff did not include this project in any scenario because we did not believe that the completion schedule is firm and reliable enough at this time.

There are a number of projects in the CIP or CTP that will not be far enough along in the process to be considered for the anticipated FY 89 AGP staging ceiling capacity. They include: the section of the ICC from Shady Grove Road to Norbeck Road (MD 28), MD 124/Shady Grove Road Connector from Railroad Street to Crabbs Branch Way extension, widening Goshen Road from Odend'hal Road to Warfield Road, Watkins Mill Road extended from Clopper Road (MD 117) to Frederick Avenue (MD 355), and Wightman Road from Montgomery Village Avenue to Goshen Road. These projects were considered in the staging ceilings developed for the RTAS FY 88 AGP and the RTAS FY 89 AGP alternatives. Montgomery Village Avenue from Lost Knife to Wightman Road was not included because its completion schedule was not considered to be firm and reliable enough.

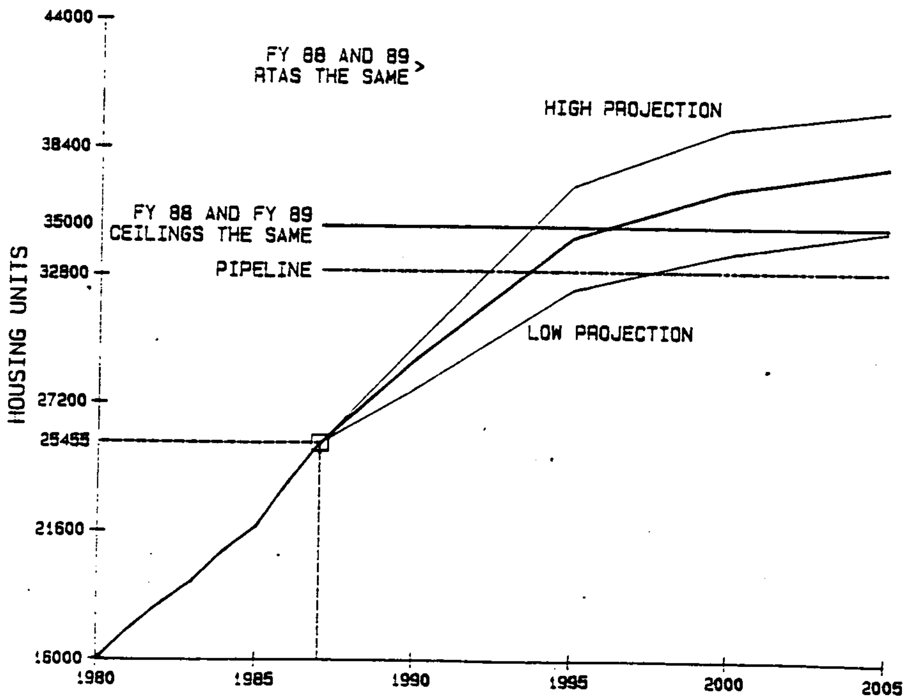
GAITHERSBURG EAST

JOBS



PIPELINE IS BUILT OUT BY 1998, 10 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1995, 7 YEARS

GAITHERSBURG WEST

Current Transportation Conditions

Transit Availability: Gaithersburg West area has been served for some tim by the MCDOT Ride-On bus system. Metrorail service opened to Shady Grove in December 1984. An expansion and restructuring of the Metrobus/Ride-On system was implemented in conjunction with the rail opening. An extensive network of Ride-On routes serves the Quince Orchard/ Shady Grove area, with terminal point in the system being at Lake Forest Mall, Shady Grove Metro and Rockville Metro. The new areas served by the Ride-On system as a result of restructuring due to the rail opening include the Shady Grove Life Sciences Center and areas along Fields Road. The new commuter rail station at Metropolitan Grove Road opened i 1987.

Level of Service Conditions: The estimate of the average LOS is that it i the same as the average LOS C/D set as the standard for this area. The recent completion of several transportation projects has improved the local traffic conditions in this area, particularly along MD 28 and Shady Grove Road. Also, this area is programmed to receive additional transportation improvements from the large number of transportation projects contained in the adopted CIP and CTP. Nevertheless, there are a few intersections as well as roadway segments i this area operating at or approaching Level of Service E. Such conditions can be found along MD 28 west of Treworthy Road, Clopper Road (MD 117) west of Longdraft Road, and the intersections of Clopper Road (MD 117)/ Quince Orchard Road (MD 124), Darnestown Road (MD 28)/Quince Orchard Road (MD 124), and Shady Grove Road/Research Boulevard.

Programmed Transportation Improvements:

The Gaithersburg West area has many programmed transportation improvement projects. These transportation improvement projects include: I-270 widening, I-370 and Sam Eig Highway, Great Seneca Highway Phase II and Phase III, Muddy Branch Road, Longdraft Road, Fields Road, Key West Avenue Projects and Key West - MD 28 Phase III.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceiling provides for 717 jobs above the pipeline and 3,018 housing units above the housing unit pipeline. It should be noted that the development of most of this policy area is controlled by the staging element of the approved and adopted Gaithersburg Vicinity Master Plan. The staging requirements in the Master Plan have resulted in closer coordination between the construction of new development and the construction of the roadways needed in serving new development.

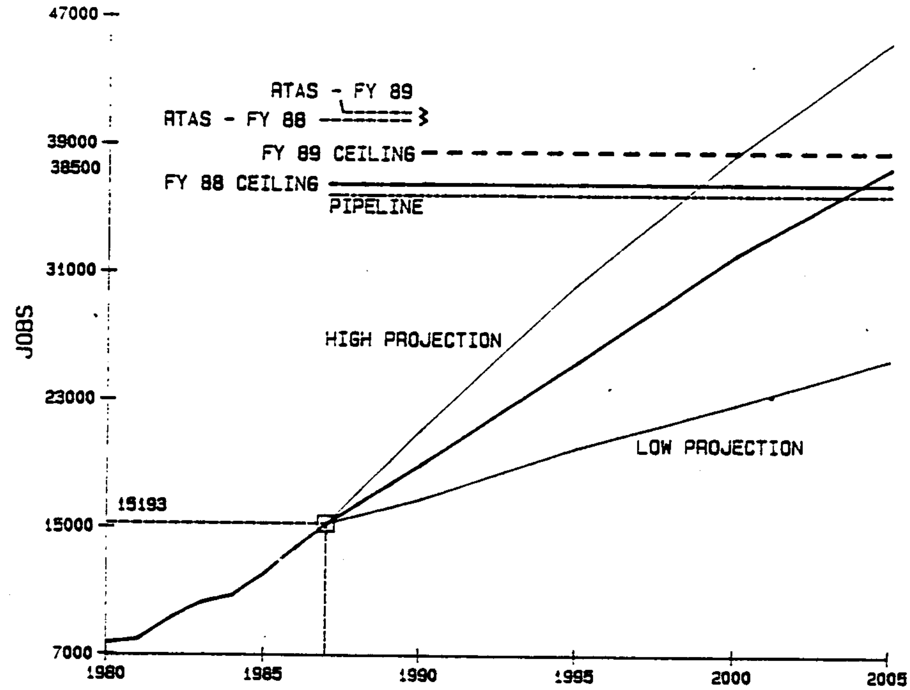
Alternative Transportation Improvements and Staging Ceilings

The anticipated FY 88-93 CTP accounts for the construction of MD 28 relocated from Shady Grove Road to I-270. The anticipated FY 89 AGP ceilings include this project.

The following projects would qualify to be included in both the RTAS FY 88 AGP and the RTAS FY 89 CTP staging ceilings. These projects are the widening of MD 28 from Key West to Jones Avenue, the widening of MD 28 from Quince Orchard to Jones Avenue, and the extension of Watkins Mill Road from Clopper Road (MD 117) to Frederick Avenue (MD 355).

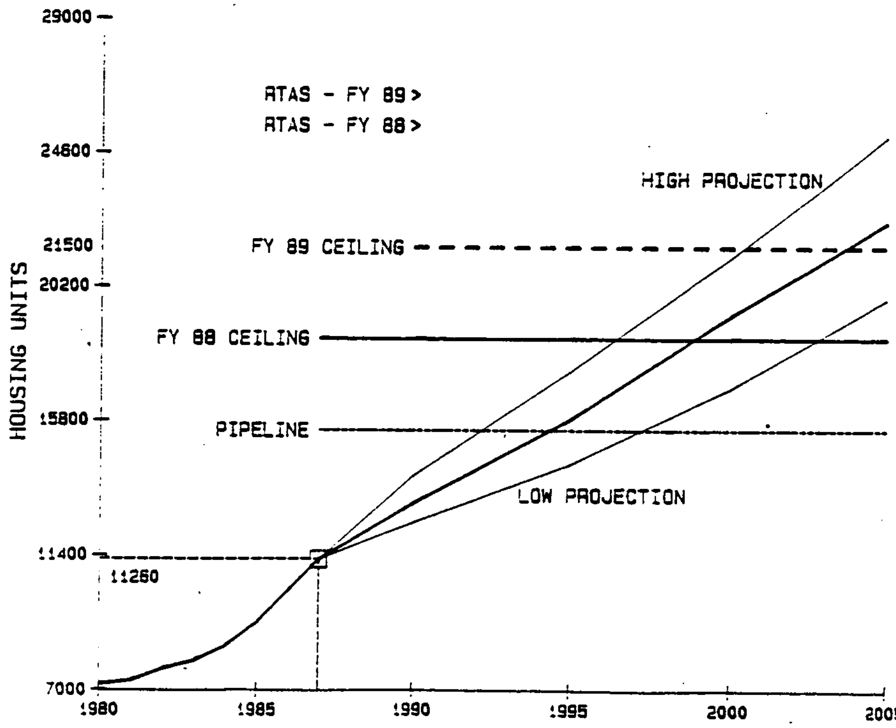
GAITHERSBURG WEST

JOBS



PIPELINE BUILDS OUT AFTER THE YEAR 2000

HOUSING



PIPELINE IS BUILT OUT BY 1994, 6 YEARS

GERMANTOWN EAST

Current Transportation Conditions

Transit Availability: Since June 1980, MCDOT Ride-On community bus has been serving this area from the Lakeforest Mall in Gaithersburg via Frederick Avenue, Middlebrook Road, and MD 118. With the opening of Metro to Shady Grove in December 1984, bus routes were restructured in the corridor. Additional bus services has been added in 1986, first as part of the Emergency Appropriations Request and then as one of the short-term traffic alleviation measures.

Level of Service Conditions: An estimate of the average LOS is that it is currently more congested than the average of LOS C set as the standard for this area. There are local intersection capacity problems at MD 355 and MD 27, and MD 355 and Middlebrook Road. Insufficient roadway segment capacity exists on MD 118.

Programmed Transportation Improvements

The widening of I-270 and the interchange at Middlebrook Road are programmed projects as is the Watkins Mill school access Road. A developer obtained approval of a preliminary plan by agreeing to construct a 4-lane divided section of Middlebrook Road from I-270 to M-8

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceilings are exceeded by the pipeline for both jobs and housing units, resulting in zero net available jobs and housing units.

Alternative Transportation Improvements and Staging Ceilings

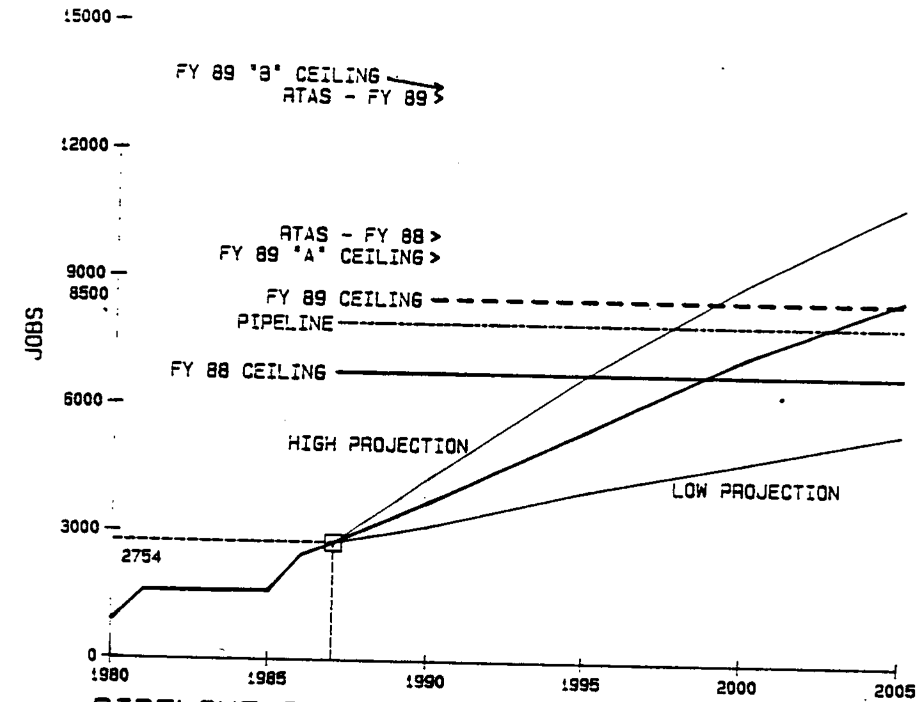
The anticipated FY 89 AGP includes the construction of relocated MD 118 from I-270 to MD 355 as a 6-lane roadway: The Germantown/Montgomery Village connector is also expected to be available for consideration, however, staff has not included this project in the ceilings proposed for the anticipated FY 89 AGP because we do not believe that the completion schedule is firm and reliable enough at this time.

The County Executive and MCDOT asked that Augmented A, and B of the anticipated FY 89 AGP be augmented to include the extension of Germantown Drive across I-270 to MD 27 including an interchange at I-270. A separate analysis of staging ceiling capacity provided by the segments of this facility were developed as Augmented A and Augmented B of the anticipated FY 89 AGP. Augmented A just includes the extension of Germantown Drive, in three phases, while Augmented B also allows for the interchange of Germantown Drive with I-270.

The alternatives related to FY 88 RTAS and FY 89 RTAS also include ceiling capacity related to the extension of Germantown Drive but only the FY 89 RTAS includes the interchange with I-270. Due to the need for special Federal Highway approval and the necessary studies which have yet to begin, the schedule for the proposed interchange of Germantown Drive with I-270 is not considered as being firm and reliable enough at this time for the FY 88 RTAS. However, it has been included with the FY 89 RTAS pending progress this spring on the Federal approvals. The proposed phases of the Germantown Drive project itself have appropriately included in the FY 88 and FY 89 RTAS analyses.

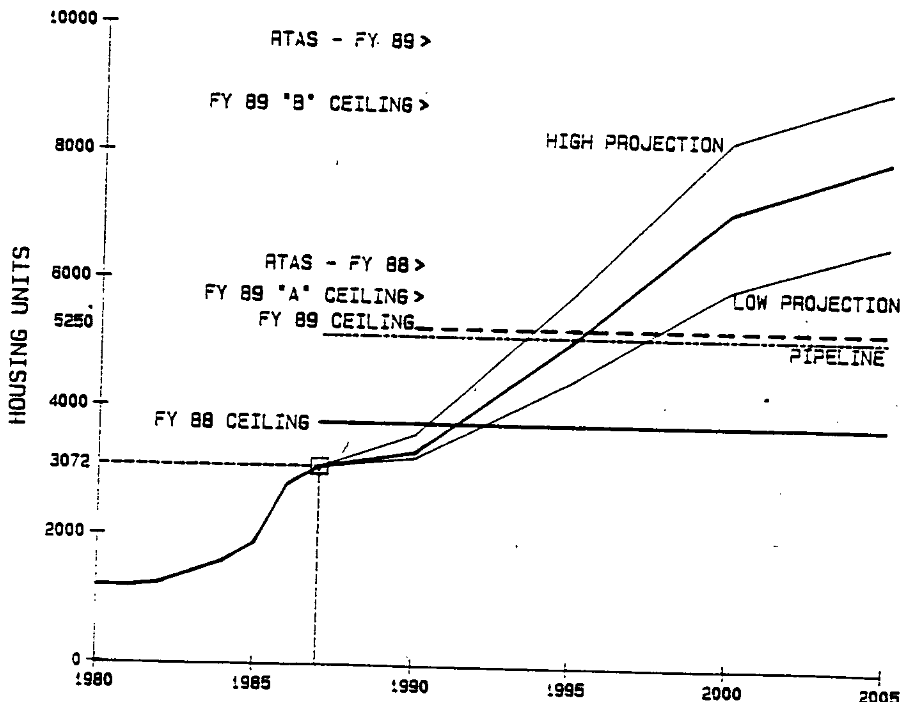
GERMANTOWN EAST

JOBS



PIPELINE BUILDS OUT AFTER THE YEAR 2000

HOUSING



PIPELINE IS BUILT OUT BY 1995, 7 YEARS

GERMANTOWN WEST

Current Transportation Conditions

Transit Availability: Since June 1980, MCDOT Ride-On Community Bus has been serving this area from the Lakeforest Mall. With the opening of Metro to Shady Grove in December 1984, routes were restructured and service was directed towards the Shady Grove Metro Station. Additional bus service has been added in 1986 first as part of the emergency appropriation request and then as one of the short-term traffic alleviation measures. Commuter rail service is provided by MDDOT from the Germantown station.

Level of Service Conditions: An estimate of the current average LOS is that it is more congested than the average LOS C set as the standard for this area. At the present time all intersections are operating at acceptable LOS until traffic from pipeline development is considered. When pipeline traffic is considered, there are intersection capacity problems at Germantown Road (MD 118) and Aircraft Drive, and some congested local conditions at Germantown Road (MD 118) and Middlebrook Road.

Programmed Transportation Improvements

There are seven projects considered as programmed in the setting of the adopted staging ceiling: (1) I-270 widening and the Middlebrook Road interchang (2) Crystal Rock Drive, (3) Germantown Drive, (4) the project by MCDOT on Clopper Road (MD 117), (5) MD 118 Relocated (Germantown Road), (6) Great Seneca Highway Phase III, and (7) Middlebrook Road widening. There is also a CIP project to increase the number of parking spaces available at the Germantown Commuter Rail station. The Crystal Rock Drive project and the Middlebrook Road projects assume developer participation.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceilings are exceeded by the pipeline for both jobs and housing units, resulting in zero net available jobs and housing units.

Alternative Transportation Improvements and Staging Ceilings

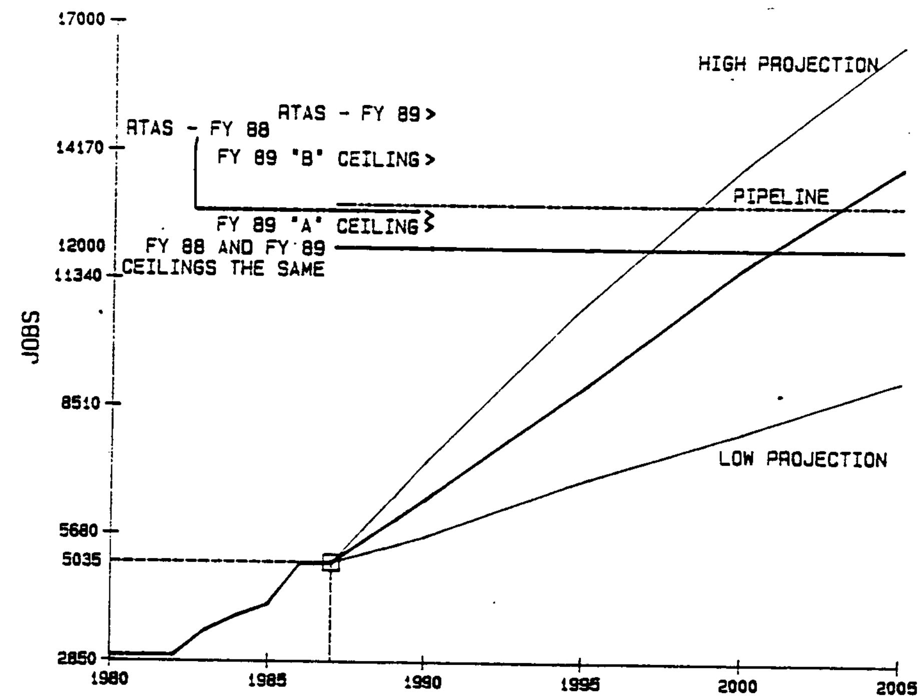
The staging ceilings developed for the anticipated FY 89 AGP assumes that Waring Station Road between Clopper Road (MD 117) and the B&O Railroad is being widened to 4 lanes.

The County Executive and MCDOT requested that the anticipated FY 89-94 CIP be augmented by expediting the programming of Germantown Drive between Crystal Rock Drive and MD 355 and by an interchange between Germantown Drive and I-270. The ceilings produced for FY 89 Augmented A, and FY 89 Augmented B are based on these additions. Augmented A just includes the extension of Germantown Drive, in three phases, while Augmented B also allow for the interchange of Germantown Drive with I-270.

The alternatives related to the FY 88 RTAS and the FY 89 RTAS also include ceiling capacity related to the extension of Germantown Drive but only the FY 89 RTAS includes the interchange with I-270. Due to the need for special Federal Highway approval and the necessary studies which have yet to begin, the schedule for the proposed interchange of Germantown Drive with I-270 is not considered as being firm and reliable enough at this time for the FY 88 RTAS. However, it has been included with the FY 89 RTAS pending progress this spring on the Federal approvals. The proposed phases of the Germantown Drive project itself have been appropriately included in the FY 88 and FY 89 RTAS analyses.

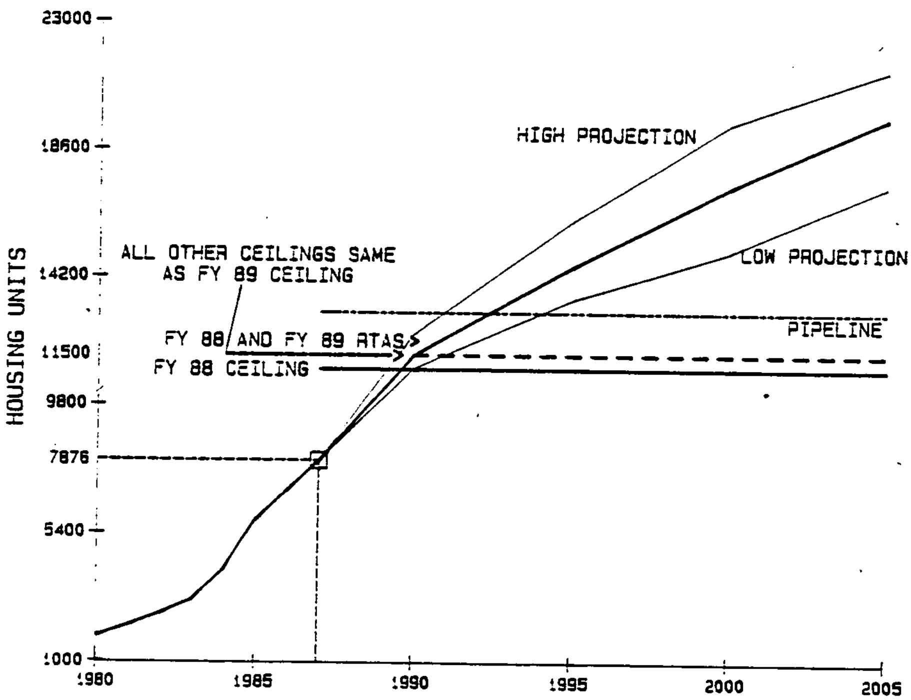
GERMANTOWN WEST

JOBS



PIPELINE BUILDS OUT AFTER THE YEAR 2000

HOUSING



PIPELINE IS BUILT OUT BY 1992, 4 YEARS

KENSINGTON/WHEATON

Current Transportation Conditions

Transit Availability: This area is well served by regional bus service with many routes having demand based frequencies, several MCDOT Ride-On routes, commuter rail service, park and ride lot, as well as express bus connections to the Silver Spring Metro station.

Level of Service Conditions: An estimate of the average LOS is that it is currently less congested than the average LOS D set as the standard for this area. There are several local intersections in the area currently operating at or lower than Level of Service E, and many at Level of Service D. Most of these local congested conditions occur along Randolph Road, Georgia Avenue, Connecticut Avenue, Veirs Mill Road, and University Boulevard.

Programmed Transportation Improvements

There are several programmed transportation project in this area including the reconstruction and widening of Layhill Road from George Avenue (MD 97) to north of Longmead Road which is in the adopted CTP. There are three programmed transit projects in this area: 1) the Glenmont Metrorail line with stations at Forest Glen and Wheaton scheduled to open in 1989, 2) a parking garage at the Wheaton Metro station to provide for enhanced parking, and 3) a park and ride lot at the Glenmont station. The widening of Veirs Mill Road from Randolph Road to Connecticut Avenue (MD 185) is also listed in the Adopted CTP as a special project. The widening of Forest Glen Road from Georgia Avenue (MD 97) to Belvedere Place is funded and will be constructed by WMATA. There are two primary residential streets listed in the Adopte CIP. They are Belvedere Place extension from Forest Glen Road (MD 192 and Dewey Road from Dahill Road to Garrett Park Road.

Adopted Staging Ceilings Relative to the Pipeline

The adopted staging ceilings provide for 8,630 jobs and 835 housing units above the pipeline. A technical adjustment to the Adopted Staging Ceilings is proposed to better balance the jobs and housing ceilings. A shift by reducing the jobs ceiling by 4,000 jobs and increasing the housing units ceiling by 2,000 has been included.

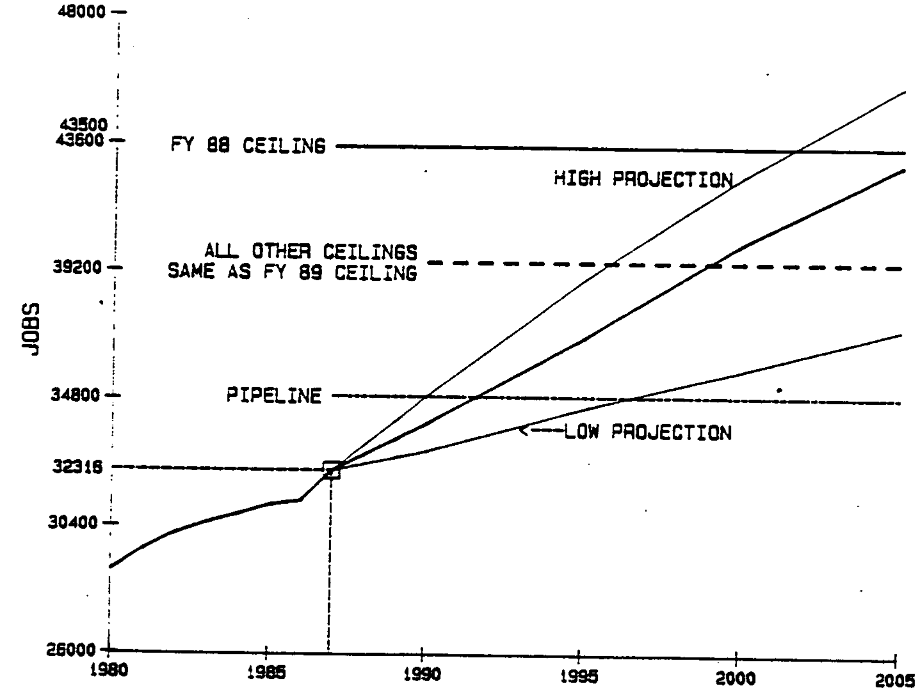
Alternative Transportation Improvements and Staging Ceilings

There are no additional projects that are expected to be availabl to increase the staging ceiling under any of the alternatives. The conditions to trigger consideration of projects under the proposed RTAS amendment are not met in the Kensington/Wheaton Area.

There are a number of transportation projects that are starting to show up in the later years the CIP and CTP that could begin to provide additional Staging Ceiling in future years. The section of the Intercounty Connector from Norbeck Road (MD 28) to Columbia Pike (US 29) and the grade separation and interchange of US 29 at Universit Boulevard (MD 193) will probably have the largest affect on ceilings when they have progressed far enough to be considered. If the RTAS trigger conditions would have been met in this area, it would have been recommended to not yet count the proposed grade separation of US 29 and University Boulevard (MD 193) as the construction schedule is not considered as being firm and reliable enough at this time.

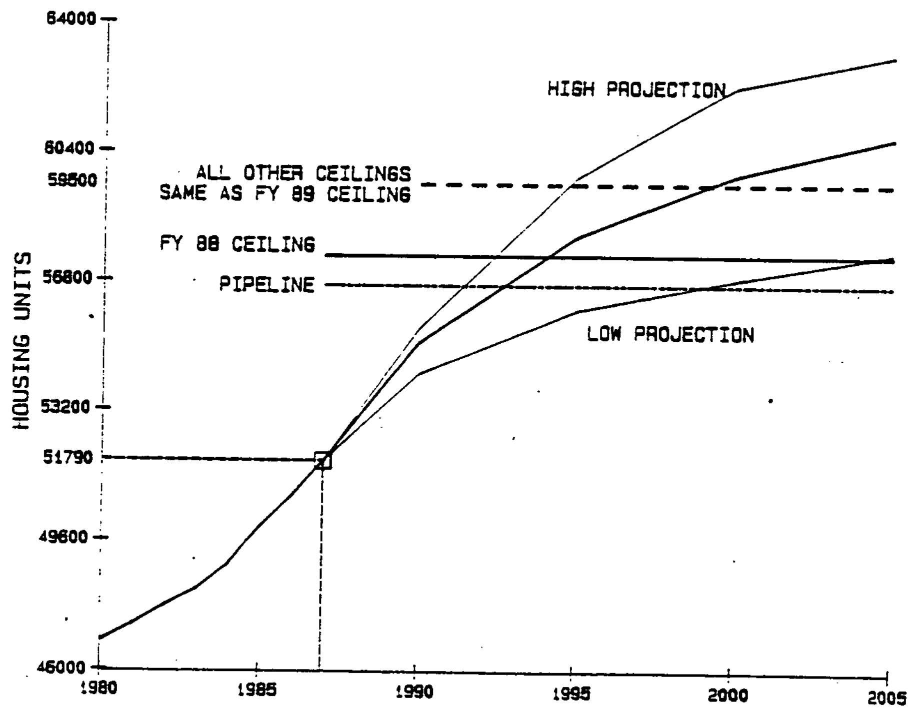
KENSINGTON/WHEATON

JOBS



PIPELINE IS BUILT OUT BY 1991, 3 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1994, 6 YEARS

NORTH BETHESDA

Current Transportation Conditions

Transit Availability: Metrorail service now has been operating since Decembe[r] 1984 at the Grosvenor, White Flint and Twinbrook StationS, and is augmented by a restructured bus system feeding the stations and their immediate vicinities. Ther[e] is a differentiation in the frequency of rail service at the Grosvenor station wit[h] every other train going to Shady Grove and the others turning back towards downtow[n] Washington. This results in the frequency of service at the White Flint and Twinbrook stations being half of what it is at the Grosvenor station and the stations [o] the Red Line to the south. The bus sytem provides moderate coverage and combines routes with policy headways and more frequent demand-based service.

Level of Service Conditions: An estimate of the average LOS is that it is currently less congested than the average LOS D set as the standard for this area. There are many local intersections in the North Bethesda area at or approaching LO[S] or LOS F conditions. Such conditions can be found along Montrose and Randolph Roa[d] Rockville Pike, Old Georgetown Road, Democracy Boulevard, Twinbrook Parkway, Nichol son Lane, and Tuckerman Lane.

Programmed Transportation Improvements

The major programmed project in this area is the widening of I-270 from the I-270 Spurs to Montrose Road and the north. There is also an interchange im-proveme[n] at Montrose Road and the reconstruction of the Montrose Road Bridge which is alrea[d] in progress. The widening of Montrose Road from Westmont Boulevard to Old Bridge Road and the construction of Woodglen Drive from Nicholson Lane to Security Lane a[r] also programmed in the CIP. The North Bethesda area also has developer funded traf[f] alleviation measures with relatively long-term commitments serving the Davis Tract area and the Executive Boulevard area.

Adopted Staging Ceilings Relative to the Pipeline

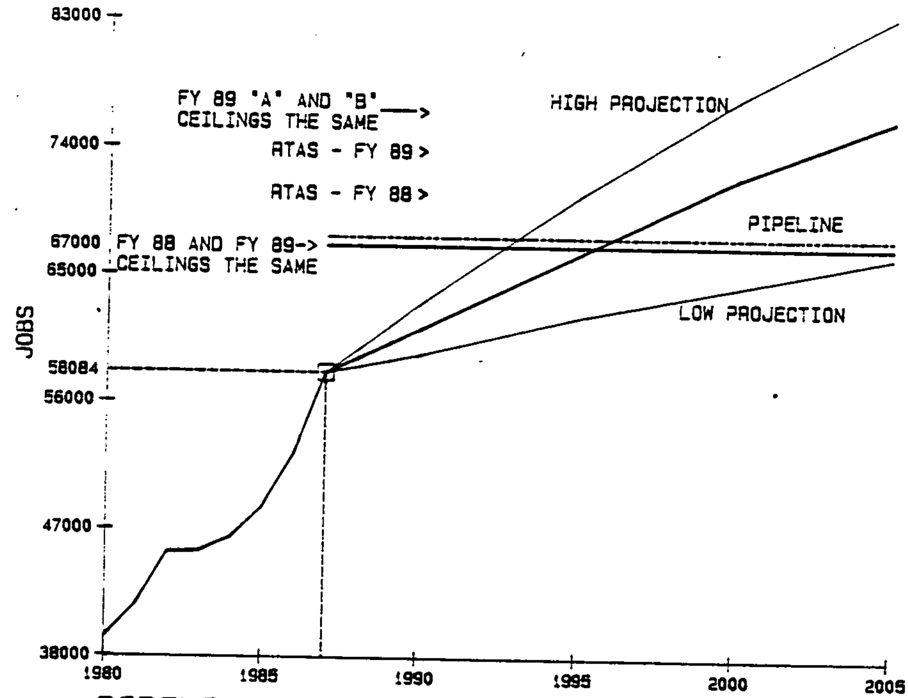
The pipeline exceeds the staging ceiling for both jobs and housing units.

Alternative Transportation Improvements and Staging Ceilings

There are no transportation improvements that can be used to increase ceiling[s] in the Anticipated FY 89 AGP based upon the FY 89-94 CIP or FY 88-93 CTP. However, the County Executive and MCDOT has suggested the possibility of accelerating the design and construction of the two spurs of I-270. MDDOT and MCDOT are studying t[h] possibility of accelerating these two projects to the point that they would qualif[y] for staging ceiling. These projects are 1) widening I-270 East Spur from I-270 Y split to I-495, and 2) widening I-270 West Spur from I-270 Y split to I-495. Both projects are included in the Augmented A and Augmented B additions to the FY 89 AG[P] Staging Ceilings. The draft FY 88-93 CTP has not shown a schedule for these proje[c] in the absence of funding participation from the County. For purpose of the RTAS analysis it is assumed that SHA could solely fund the East Spur by FY 94 and the We[st] Spur by FY 95.

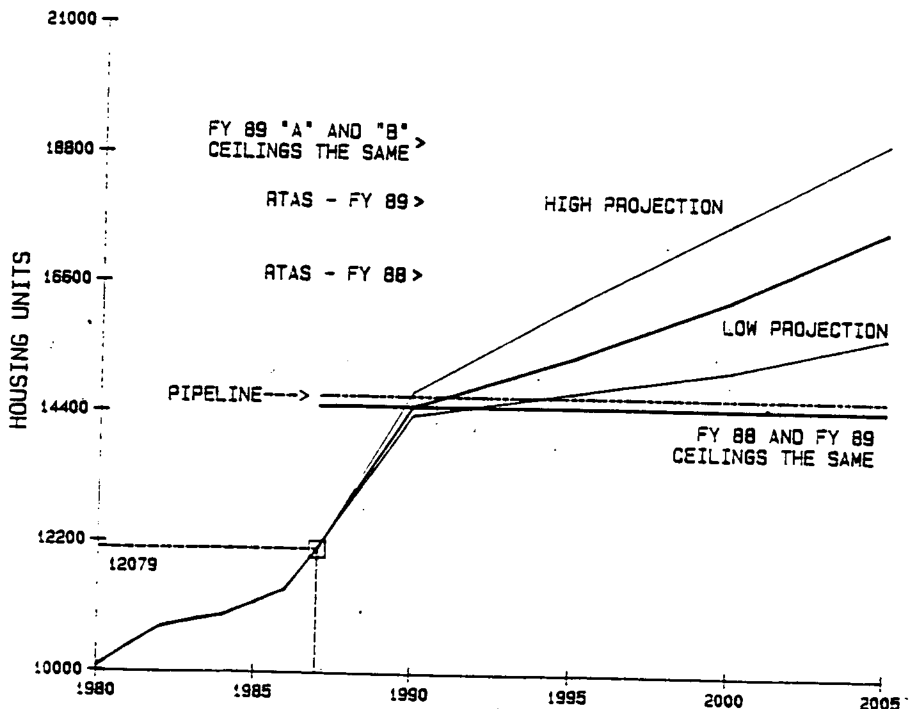
The following additional projects are listed in the CIP or CTP but have not progressed to the point where they can be considered for staging ceiling. They ar[e] (1) the grade separation of Rockville Pike (MD 355) at Montrose/Randolph Roads and the B&O Railroad crossing, (2) Edson Lane from Rockville Pike (MD 355) to Wood-gle[n] Drive, and (3) I-270 overpass connecting Fernwood Road to Westlake Drive.

NORTH BETHESDA
JOBS



PIPELINE IS BUILT OUT IN 1996, 8 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1991, 3 YEARS

OLNEY

Current Transportation Conditions

Transit Availability: The Olney area is currently served by regional bus lines on Georgia Avenue, New Hampshire Avenue, and MD 108. A park and ride lot at Norbeck Road and Georgia Avenue is served by Metrobus. A Ride-On route provides service along Cashell Road and Bowie Mill Road as well as to the area to the north of MD 108 and west of Georgia Avenue.

Level of Service Conditions: The estimate of the current average LOS is that it is at the average LOS C set as the standard for this area. Portions of the improvement of Georgia Avenue between Norbeck Road and MD 108 have recently opened to traffic and current local information is not yet available. The intersection of Georgia Avenue (MD 97) and MD 108 is at capacity when background traffic is added to existing traffic. Recently approved preliminary plans required developers to add right-turn lanes as a condition of approval.

Programmed Transportation Improvements

The adopted CIP and state CTP include the widening of the 2-lane section of Georgia Avenue between Norbeck Road and MD 108. This is a joint MCDOT/MDDOT project which is now under construction. The connection of Briars Road, a primary residential street, to Olney-Laytonsville Road (MD 108) is also included in the Adopted CIP.

Adopted Staging Ceilings Relative to the Pipeline

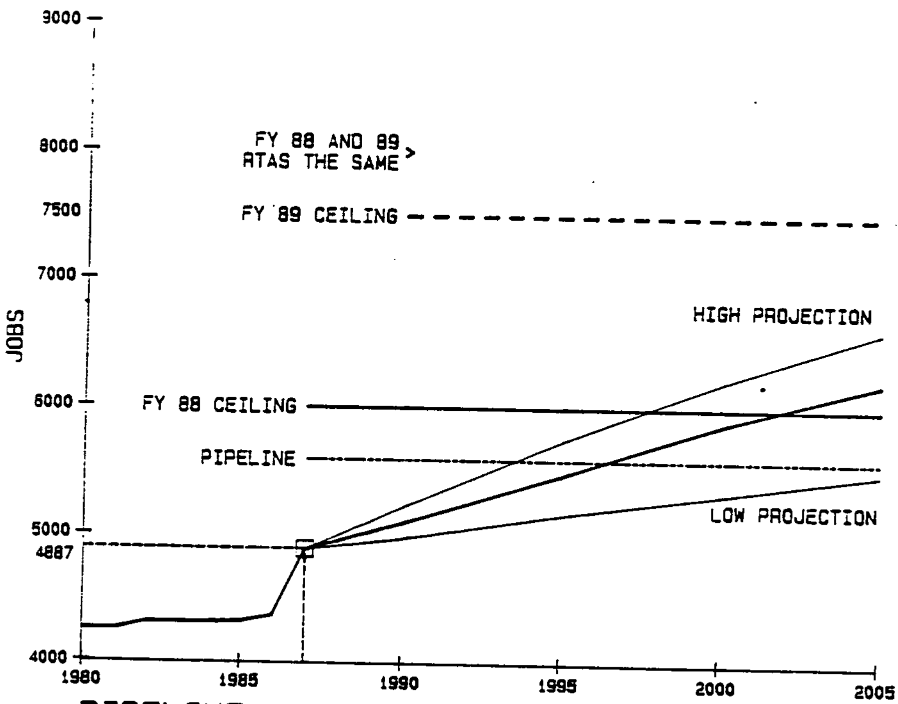
The adopted staging ceiling provides for 415 available jobs and for 391 available housing units.

Alternative Transportation Improvements and Staging Ceilings

The State's project to widen Olney-Sandy Spring Road (MD 108) from Olney Mill Road to Dr Bird Road will qualify for consideration in the Anticipated FY 89 AGP. The Intercounty Connector from Shady Grove Road to Norbeck Road (MD 28) is listed in the CIP such that the FY 88 RTAS ceiling and the FY 89 RTAS ceilings include this project. The resulting ceilings essentially reach the holding capacity of the Olney Master Plan and for the General Plan for this area.

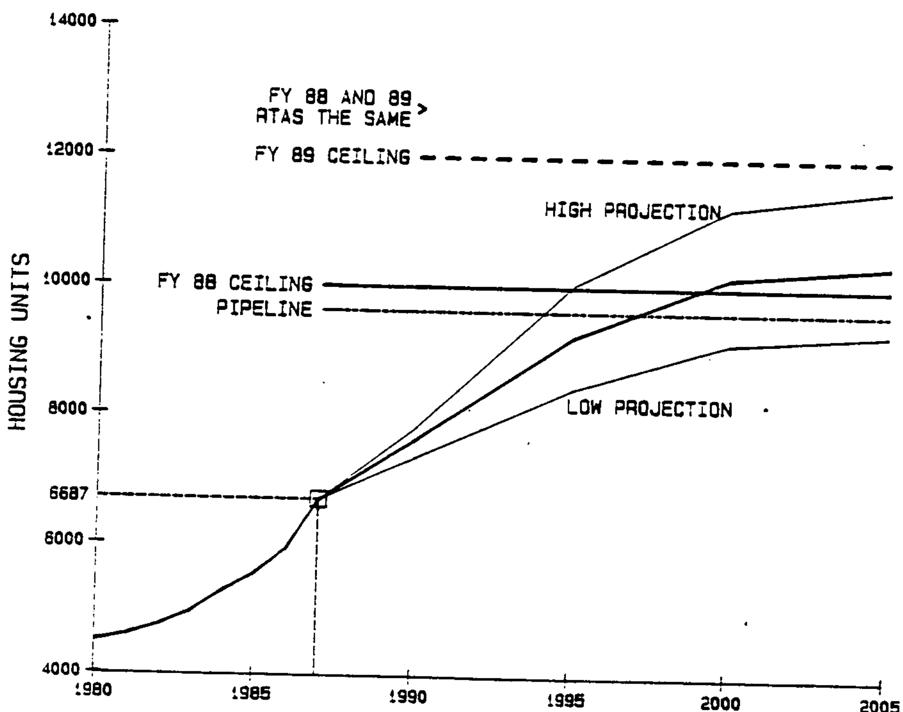
OLNEY

JOBS



PIPELINE IS BUILT OUT BY 1996, 8 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1996, 8 YEARS

POTOMAC

Current Transportation Conditions

Transit Availability: Potomac is currently served by the regional bus system parts of Seven Locks Road, Falls Road, River Road, and Bradley Boulevard. Since th opening of the Metro line to Shady Grove in December 1984, several MCDOT Ride-On bu routes serve the Potomac area east of Falls Road. Fringe parking will continue to available at Montgomery Mall.

Level of Service Conditions: An estimate of the average LOS is that it is currently less congested than the average LOS C set as the standard for this area. The most severe local congestion in the Potomac area occurs on Seven Locks Road alo most of its length north of River Road. The recent completion of Montrose Road Extended has improved conditions in that area while the local congestion at other locations will be decreased due to other projects in the CIP. The intersections of River Road (MD 190) with Falls Road (MD 189) and with Bradley Boulevard (MD 191) ar also congested.

Programmed Transportation Improvements

Projects in the CIP for this area include; (1) Democracy Boulevard Extended, a (2) Seven Locks Road Phase I from south of River Road to Dwight Drive. Also in nea by Rockville is the Ritchie Parkway project to extend Ritchie Parkway from its present terminus at Seven Locks Road to Rockville Pike. Oaklyn Drive between Falls Ro (MD 189) and Oaklyn Court and Oaklyn Drive Bridge, currently only one lane wide, ar funded for reconstruction to a rural arterial roadway standard. The developer of Avenel Farm will extend Oaklyn Drive from Oaklyn Court to Bradley Boulevard/Persimm Tree Lane.

Adopted Staging Ceilings Relative to the Pipeline

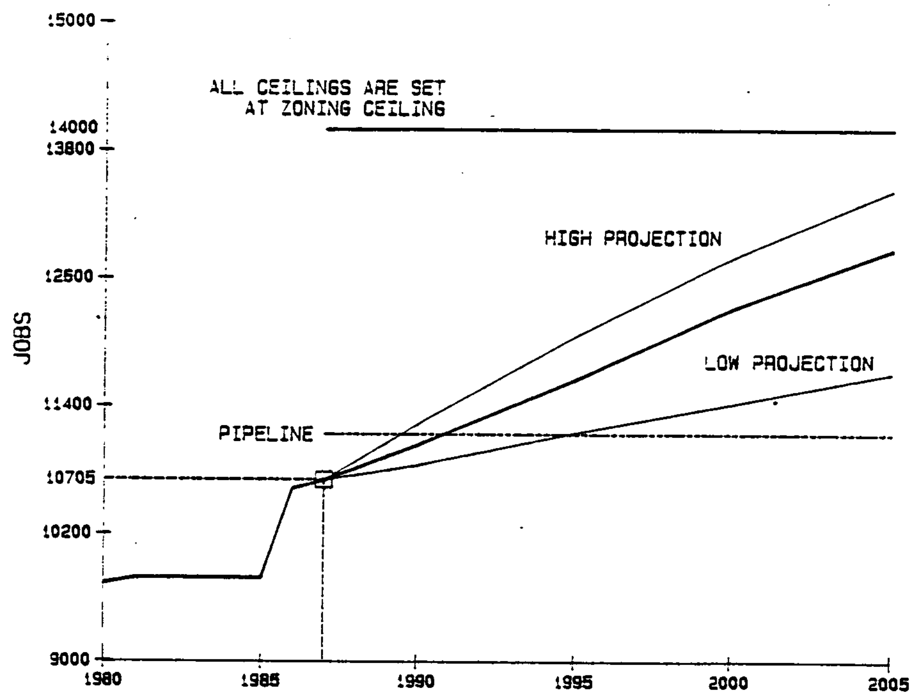
The Master Plan for the Potomac Subregion, adopted in 1980, specified retainin two-lane cross sections for most roads, even though congestion will occur. It further specified that when the extensions of Democracy Boulevard and Montrose Road ar at least 50 percent programmed for construction, the remaining vacant land in the area can develop to the extent allowed by the then-proposed zoning. This will resu in zoning ceilings of approximately 2,157 Housing units and 2,867 Jobs above the present pipeline. The Plan notes that the full zoning development will likely resu in traffic congestion in excess of standards for a Group II policy area.

In the "Potomac Policy Area" part of the Potomac Subregion Master Plan, local area congestion reviews will not be required. This is in accordance with the Maste Plan which indicates that since the area is in effect a cul-de-sac with little through traffic, the County Council will pursue a policy of maintaining two-lane roads, with two exceptions. The County Council recognizes that this will produce levels of traffic congestion during peak periods greater than that considered accep able in other areas of the County, but feels that this is a legitimate trade-off to maintain the character of the area. The County Council further recognizes that are which contribute traffic to Seven Locks Road between Tuckerman Lane and Montrose Ro are affecting more than Potomac traffic. Subdivisions that generate more than 50 peak hour trips that affect this section of Seven Locks Road will be required to perform a Local Area Transportation Review.

Alternative Transportation Improvements and Staging Ceilings

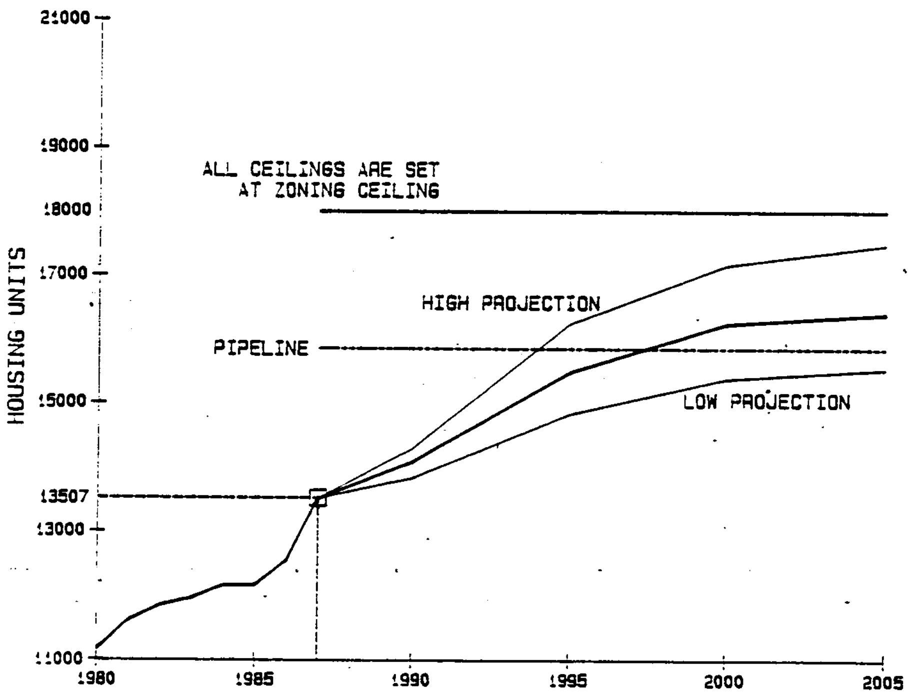
There are no CIP or CTP projects that qualify for staging ceiling. Seven Lock Road safety improvement and widening Phase II from Dwight Drive to Bradley Boulevar and the I-270 overpass to connect Fernwood Road to Westlake Terrace are listed in t CIP but no not qualify for additional Staging Ceilings. A project planning study i underway by the state for Falls Road (MD 189) from River Road to Ritchie Parkway.

POTOMAC
JOBS



PIPELINE IS BUILT OUT BY 1990, 2 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1997, 8 YEARS

ROCKVILLE

Current Transportation Conditions

Transit Availability: The area is served by regional bus service, Ride-On community bus service, a Metrorail stations, and a commuter rail station at Rockville. The bus service provide moderate coverage with routes that combine both policy frequencies and demand-based service.

Level of Service Conditions: An estimate of the average LOS is that it is currently less congested than the average LOS D that is being suggested for this policy area. Intersection congestion is found along Rockville Pike (MD 355), Veirs Mill Road (MD 586), Norbeck Road (MD 28), Gude Drive, West Montgomery Avenue (MD 28), and Falls Road (MD 189).

Programmed Transportation Improvements

Programmed projects in this area include the widening of I-270, the I-270 bridge over Richie Parkway, the I-270/Falls Road interchange, widening Gude Drive from Southlawn to MD 28, and two sections of Ritchie Parkway: (1) between Seven Locks Road and Rockville Pike (MD 355), and (2) from Falls Road (MD 189) and Seven Locks Road.

Adopted Staging Ceilings Related to the Pipeline

Staging ceilings have not been adopted for Rockville at this time. The Planning Board is suggesting that a standard of transportation service Group IV (average LOS D) be established for Rockville with the adoption of the FY 89 AGP and possibly earlier as part of the FY 88 RTAS amendment.

Alternative Transportation Improvements and Staging Ceilings

The following transportation projects are shown in Rockville's CIP and were considered by staff as qualifying to be considered in the FY 89 AGP for ceilings. Since then, staff received a letter from the city questioning the use of these projects toward establishing ceilings for the Rockville Policy Area. The ceiling shown in this document is based on these projects: (1) MD 355/MD 28 intersection improvements, (2) Chapman Avenue from Halpine Road to Rockville Pike (MD 355), (3) Fleet Street from Richard Montgomery Drive to Ritchie Parkway, (4) Jefferson Parkway form Ritchie Parkway to East Jefferson Street, (5) Rockville Pike corridor grid streets, and (6) Montrose - Jefferson Bypass. After appropriate discussion with city representatives, revision in the proposed ceilings will be offered.

CHART HAS NOT BEEN DEVELOPED FOR ROCKVILLE AT THIS TIME.

SILVER SPRING/TAKOMA PARK

(Note: This narrative will be revised next year to have a separate one for the Silver Spring CBD)

Current Transportation Conditions

Transit Availability: The Silver Spring/Takoma Park area has the best transit availability of any area in the County. The Metrorail stations at Silver Spring and Takoma Park are supported by an extensive Metrobus feeder system. MCDOT's Ride-On buses also provide feeder service as well as community circulation. The area is also well served by regional bus, some of which are express bus routes, and commuter rail service. There are expanded bus frequencies serving the Silver Spring CBD with more than 100 buses providing peak hour service to and from the CBD.

Level of Service Conditions: An estimate of average LOS is that it is currently less congested than the average LOS D/E set as the standard for this area. There are several local intersections in this area that are operating at or approaching Level of Service E. Such conditions are found along portions of East-West Highway, Georgia Avenue, Colesville Road, and University Boulevard.

Programmed Transportation Improvements

MDDOT has programmed the widening of I-495 (the Capital Beltway) to eight lanes between Georgia Avenue (MD 97) and Wisconsin Avenue (MD 355). Construction of a part of the Glenmont Line north of Silver Spring is underway, and the Wheaton and Forest Glen Stations are scheduled to open in 1989. MCDOT has taken on the direct responsibility for operating the Silver Spring Share-A-Ride Program and has programmed an expansion of service as one of the approved traffic alleviation measures. Transportation System Management has been established for the Silver Spring CBD with the goal of achieving the commuting goals for transit use and auto occupancy rates identified in the FY 88 Amendment to the AGP.

Adopted Staging Ceilings Relative to the Pipeline

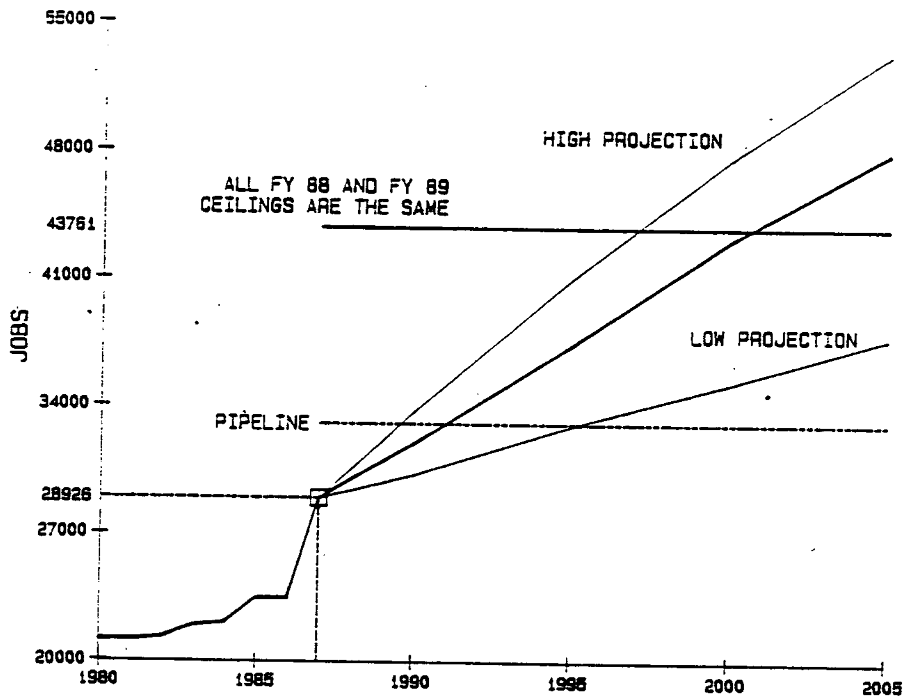
On November 10, 1987, Silver Spring/Takoma Park was separated into two policy areas (Silver Spring CBD, and Silver Spring/Takoma Park). Staging ceilings were established for each. Silver Spring CBD was established as a standard of transportation service Group VI, while Silver Spring/Takoma Park remained as a standard of transportation service Group V. The specifics are directly contained within the amended FY 88 AGP.

Alternative Transportation Improvements and Staging Ceilings

Funding for Silver Spring roadway internal circulation improvements are now shown in the Adopted CIP, without specifics as to the projects. These and other improvements will be reassessed during the coming year as part of the Traffic Management Program for Silver Spring. As indicated in the amended FY 88 AGP, the County Executive will publish a Silver Spring Traffic Management Program after receiving public comment and recommendation from the Planning Board. This program will list those actions to be taken by government to maintain traffic flow at tolerable levels in the Silver Spring CBD, and protect the surrounding residential area.

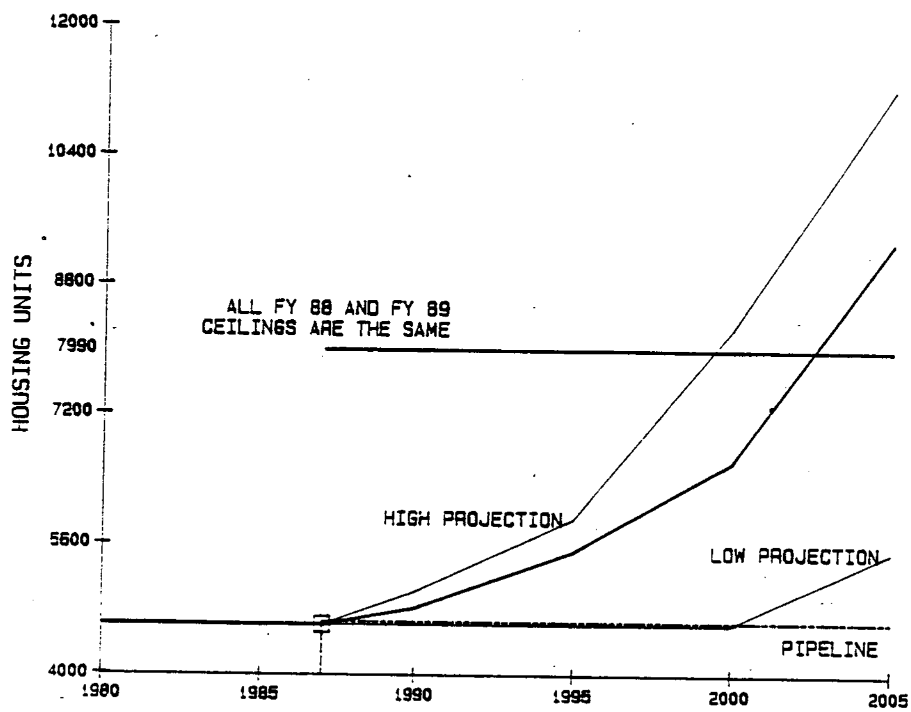
SILVER SPRING CBD

JOBS



PIPELINE BUILDS OUT BY 1991, 3 YEARS

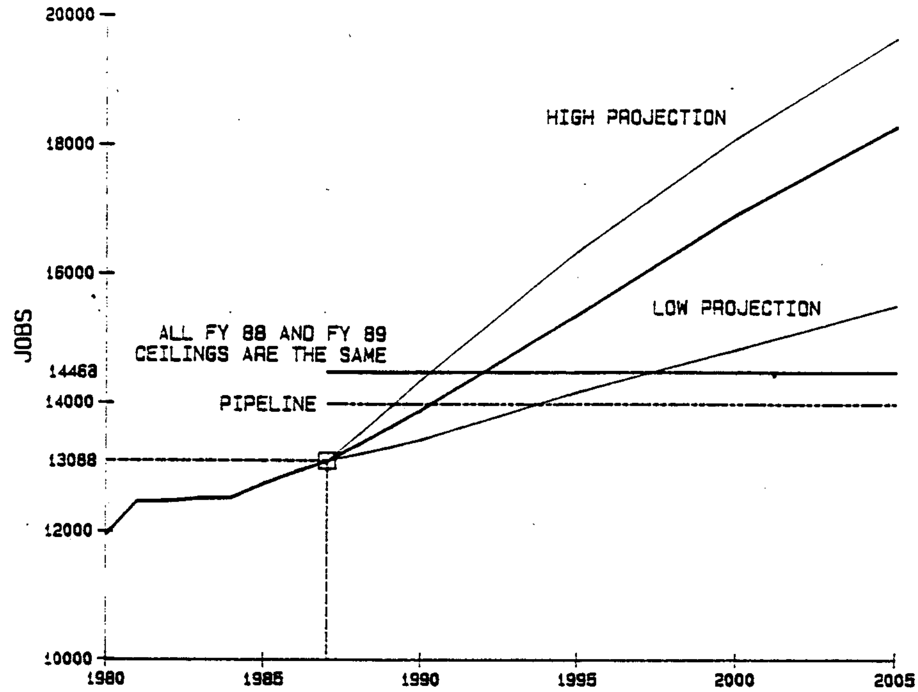
HOUSING



PIPELINE IS BUILT OUT BY 1988

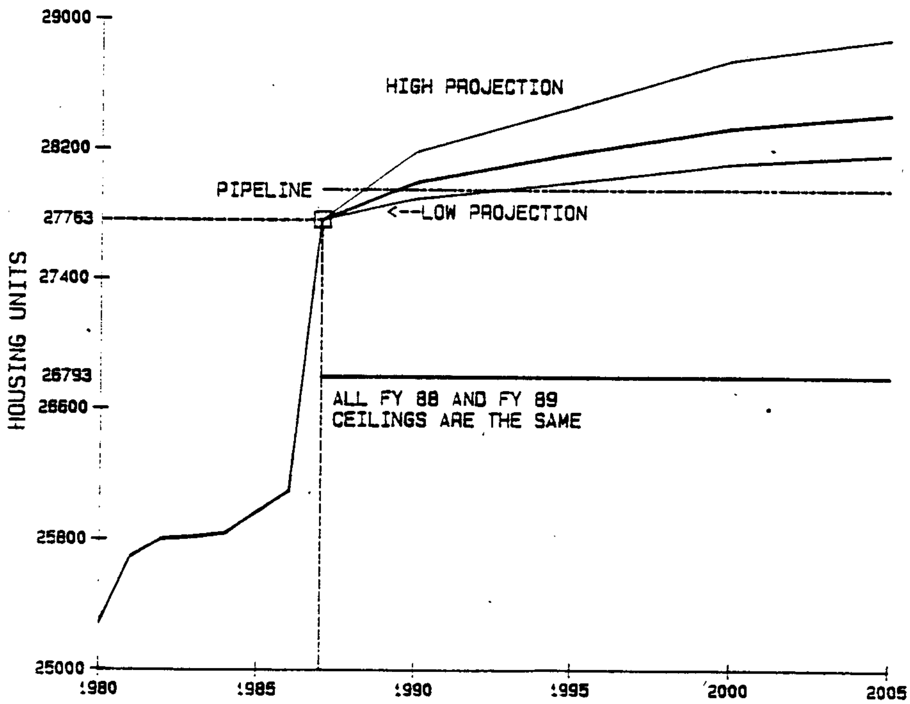
SILVER SPRING/TAKOMA PARK

JOBS



PIPELINE IS BUILT OUT BY 1990, 2 YEARS

HOUSING



PIPELINE IS BUILT OUT BY 1989

CHAPTER 4

SPECIFIC CONSIDERATIONS
FOR THE CIP REGARDING

TRANSPORTATION PROGRAM FUNDING LEVELS AND PROJECT INITIATION

CHAPTER 4

SPECIFIC CONSIDERATION FOR THE CAPITAL IMPROVEMENTS PROGRAMS REGARDING TRANSPORTATION PROGRAM FUNDING LEVELS AND PROJECT INITIATION

A. INTRODUCTION

This chapter of the report reviews historic expenditure levels by the Montgomery County Department of Transportation (MCDOT) and the State Highway Administration (SHA) on roads in Montgomery County. The analysis looks back at expenditure levels since 1970 and looks forward through the years of the adopted capital programs. The analysis shows that the recent increase in gas taxes has resulted in increased program funding levels by the SHA being made available for primary and secondary road improvements in Montgomery County. This analysis also shows that Montgomery County is programmed to receive what appears to be an appropriate proportion of these increased gas tax revenues.

This chapter of the report also looks at a comparison of this year's draft of the State's Consolidated Transportation Program (CTP) for fiscal years 88-93, with the adopted CTP from last year. This comparison is shown by project category and by program total. The effect of the gas tax increase is clearly shown through these comparisons. Finally, a set of recommendations is given regarding a) projects which should have priority for the initiation of project planning studies by the SHA and b) new projects which should be given consideration by the Executive for inclusion in latter years of the forthcoming CIP.

B. TRENDS OF EXPENDITURE LEVELS

Figure 4.1A shows the roadway construction related expenditure trends by the MCDOT for the previous 15 fiscal years and the budgeted projections through FY 1993. It shows that County expenditures on roads were relatively constant through the 1970's, began to increase slightly in the early 1980's, and have begun to accelerate significantly since fiscal years 1985 and 1986. In the early 1980's expenditure levels were about $15 million dollars annually while the expenditure levels of the past three fiscal years have shown roughly a four fold increase to about 60 million dollars annually. The adopted budget shows the expenditures in the next three fiscal years will increase another 50 to 100 percent to be on the order of 100 million dollars annually. The budgeted trend shows a decline in road expenditures in the last two years of the adopted CIP, back to expenditure levels of about 70 million dollars annually. Figure 4.1A also shows that a significant proportion of recent and budgeted County roadway expenditures will actually be for improvements to roadways which are part of the State highway system, averaging over 20 million dollars annually over the six years in the CIP.

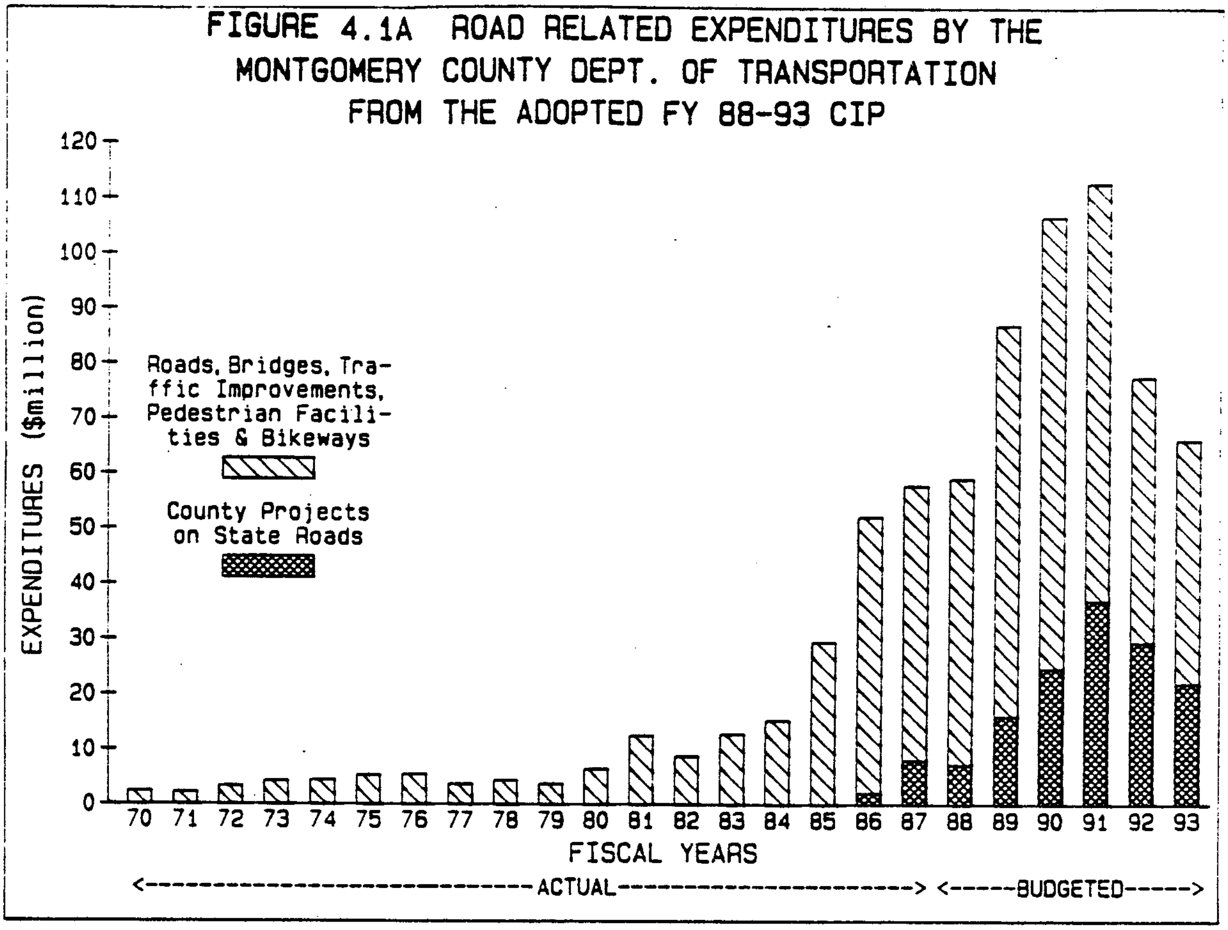


FIGURE 4.1A ROAD RELATED EXPENDITURES BY THE MONTGOMERY COUNTY DEPT. OF TRANSPORTATION FROM THE ADOPTED FY 88-93 CIP
EXPENDITURES ($million)
0 10 20 30 40 50 60 70 80 90 100 110 120
Roads, Bridges, Traffic Improvements, Pedestrian Facilities & Bikeways
County Projects on State Roads
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93
FISCAL YEARS
<----ACTUAL----> <----BUDGETED---->

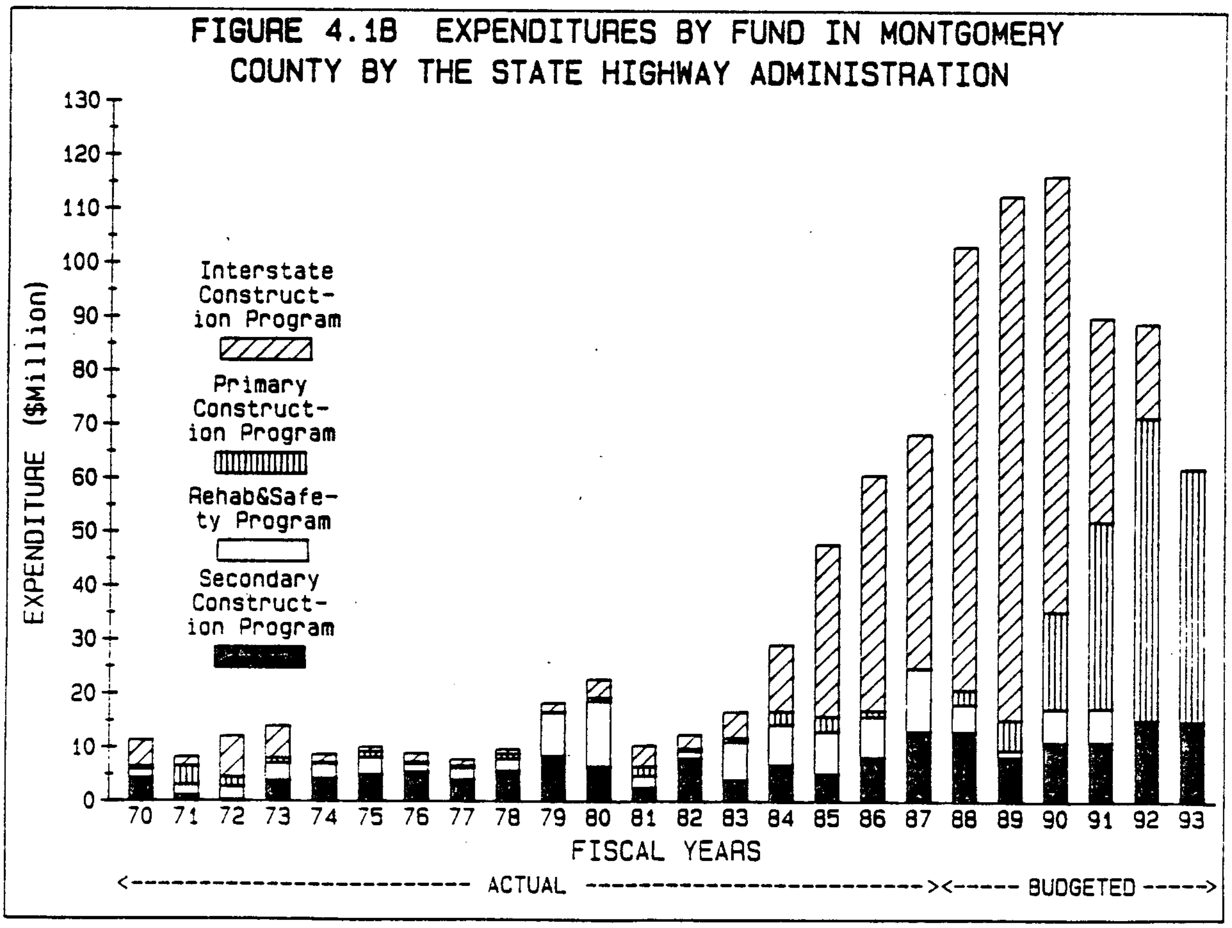


FIGURE 4.1B EXPENDITURES BY FUND IN MONTGOMERY COUNTY BY THE STATE HIGHWAY ADMINISTRATION
EXPENDITURE ($Million)
0 10 20 30 40 50 60 70 80 90 100 110 120 130
Interstate Construction Program
Primary Construction Program
Rehab&Safety Program
Secondary Construction Program
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93
FISCAL YEARS
<---- ACTUAL ----><---- BUDGETED ---->

Figure 4.1B shows a similar set of trends for highway expenditures by the SHA in Montgomery County over the same time period. It shows that the expenditure trends for primary and secondary highways appear to have been relatively constant over the past 15 years. The budgeted expenditure level for FY's 88-93 shows a moderately increasing expenditure level ranging from about 10 to 15 million dollars annually. The exhibit also shows moderate increases in the expenditures for rehabilitation and safety programs beginning around FY 1980. The most striking features of this figure, however, are first the high level of expenditures for Interstate construction which began in FY 84 and continues at very high budgeted levels over the next four fiscal years. Those expenditures are associated with improvements for various interchange improvements on I-270, the construction of I-370, the widening of I-495, and the widening of I-270. These levels of Interstate expenditures should be viewed as one-time non-recurring expenditures resulting from the way the funding of the Interstate System is structured. The second striking feature is the recently budgeted high expenditure levels for the primary construction program, with the initial segments of the Intercounty Connector.

C. <u>RESULTS OF THE RECENT INCREASE IN THE STATE GAS TAX:</u>

Figure 4.2 shows a comparison of the State Highway Consolidated Transportation Programs budgeted expenditures (CTP) for fiscal years 1987-92 and 1988-93 in Montgomery County. It shows that in the first 3 years of the draft FY 83-93 CTP, the State plans to spend an average of nearly forty percent more yearly than in the 87-92 CTP. The last three years of the draft program (i.e., FY 91-93) reflects a very large increase over the previous program in the SHA's expenditures in Montgomery County. This is a welcome trend responsive to the requests of our local elected officials that there should be 1) an increase in the revenue sources available to the Consolidated Transportation Trust Fund, as well as b) a larger share of the Statewide transportation expenditure being made available for projects in Montgomery County.

Compared with the programmed Statewide expenditure levels shown in Figure 4.3, Montgomery County is being apportioned about 22% of SHA's proposed expenditure of about 2.8 billion dollars of State funds in the FY 88-93 CTP. That percentage is up from the approximate 19 percent of the nearly 1.7 billion dollars in State funds which had been budgeted in the FY 87-92 CTP. Figure 4.3 also shows the effect of the revenue increase on SHA's statewide program. For example, the draft CTP for FY 88-93 shows an expenditure increase of about sixty five percent more than that before the revenue increase (2.8 compared to 1.7 billion dollars over the six years of the CTP). The comparable changes in programmed expenditures by SHA in Montgomery County shown in Figure 4.2 is about ninety five percent (607 million compared to 310 million dollars total over the six years of the CTP).

FIGURE 4.2 COMPARISON OF SHA'S CONSOLIDATED TRANSPORTATION PROGRAM FOR FY 1987-92 & 1988-93 IN MONTGOMERY COUNTY

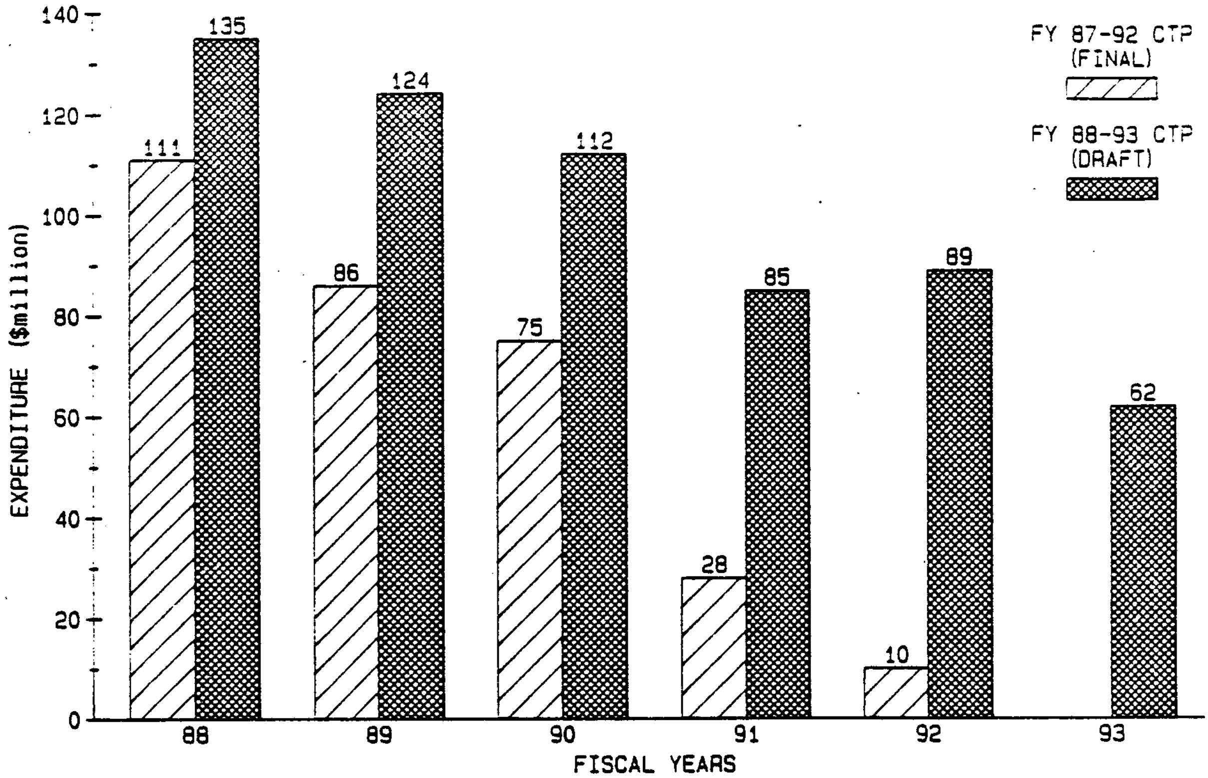
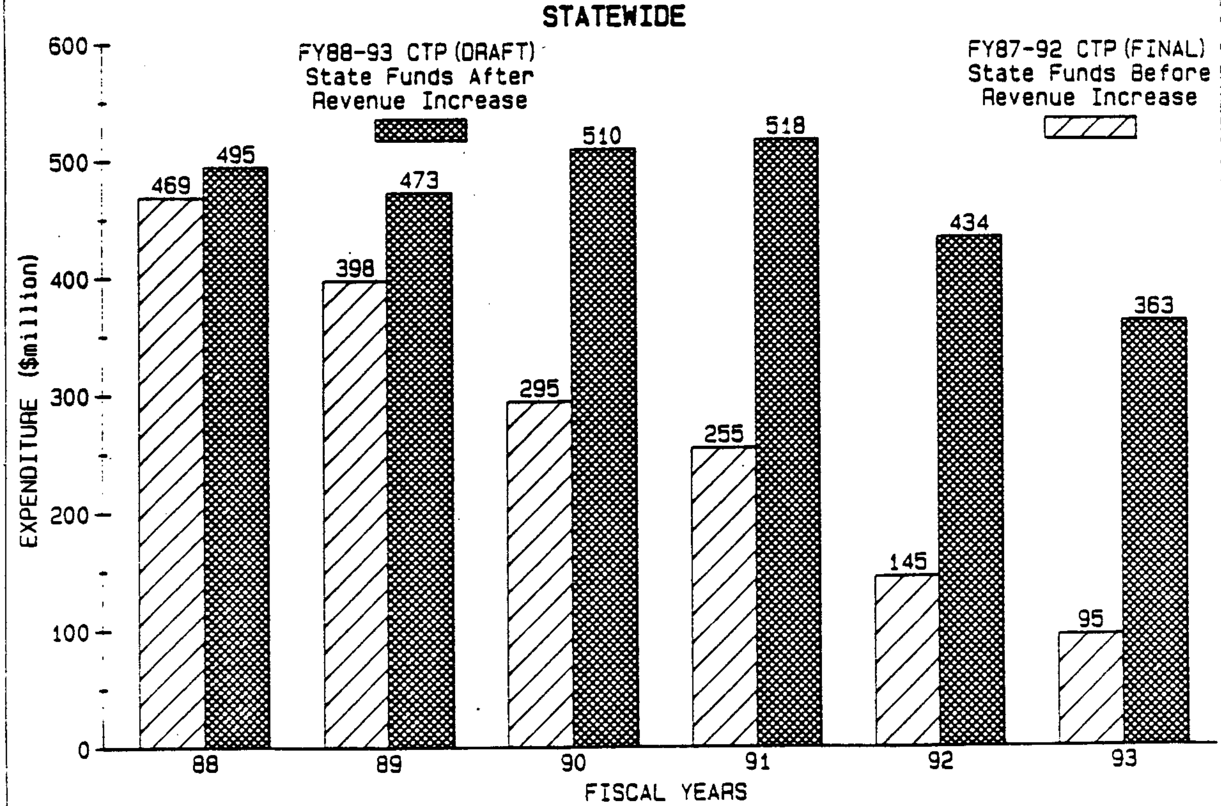


FIGURE 4.3 COMPARISON OF MD DOT'S CONSOLIDATED TRANSPORTATION PROGRAMS FOR FY 1987-92 & FY 1988-93 STATEWIDE



The above analysis shows that with the recent increase in the State gas tax Montgomery County will receive an increased proportion of the budgeted State expenditures on from the CTP, a change from about 19% to about 22%. The analysis presented in the report similar to this one showed that over the twenty year period of 1970 to 1990 Montgomery County was estimated and projected to receive about 20 to 25 percent of the statewide growth in housing and about 30 to 35 percent of the growth in jobs. Using this housing and job growth proportions as a basis of comparison it appears that the approximate 22% percent of the State highway expenditures coming to Montgomery County in the draft FY 88-98 CTP is beginning to represent a fairer share of statewide highway expenditures.

Figures 4.4 through 4.7 show more details of the effect of the recent increase in the state gas tax by looking separately at the four main categories in the construction program: 1) interstate, b) primary roads, c) secondary roads and d) the special projects program. This set of figures shows that the increased revenues benefited the primary and secondary programs the most. Most of the revenue increase has gone into the primary program, which is mostly for various segments of the Intercounty Connector. The increased expenditure level on secondary road projects should begin to restore stability to those State highway responsibilities. However, continuing expenditures by MCDOT on State highway facilities is an indication that SHA funding levels for secondary highways is still not sufficient.

D. RECOMMENDATIONS FOR PROJECT ADDITIONS TO THE CTP AND CIP

The laws governing project planning and development for State highways gives authority to locally elected officials in each County to specify the priority order for new project planning studies for State secondary highways in their respective Counties. This law has been in effect since 1979 and several project planning studies have been initiated in the order of priorities set by Montgomery County local officials including project planning for Georgia Avenue, MD 28 west of Rockville, New Hampshire Avenue, Falls Road, and, most recently, MD 355 between Gaithersburg and Germantown, which is being recommended by the SHA in the draft FY 88-93 CTP.

The draft Annual Growth Policy is the appropriate document to initially identify the annual updates to this priority list. To conform to the decision-making scheduled for the CTP, this specific recommendation needs to be dealt with by the locally elected officials ahead of the main component of the Annual Growth Policy. In this regard, Table 4.1 presents the recommended update of the priority list for the initiation of new project planning studies in Montgomery County by the SHA. Top on this list are 1) MD 124 (Gaithersburg-Laytonsville Road) as a reconstruction between Mid-County Highway and MD 108 (Damascus Road), and 2) MD 27 (Ridge Road) as a new road and reconstruction from the proposed Germantown Drive Interchange with I-270 to

FIGURE 4.4 COMPARISON OF STATE CONSOLIDATED TRANSPORTATION PROGRAM FOR FY 1987-92 & FY 1988-93

INTERSTATE CONSTRUCTION PROGRAM

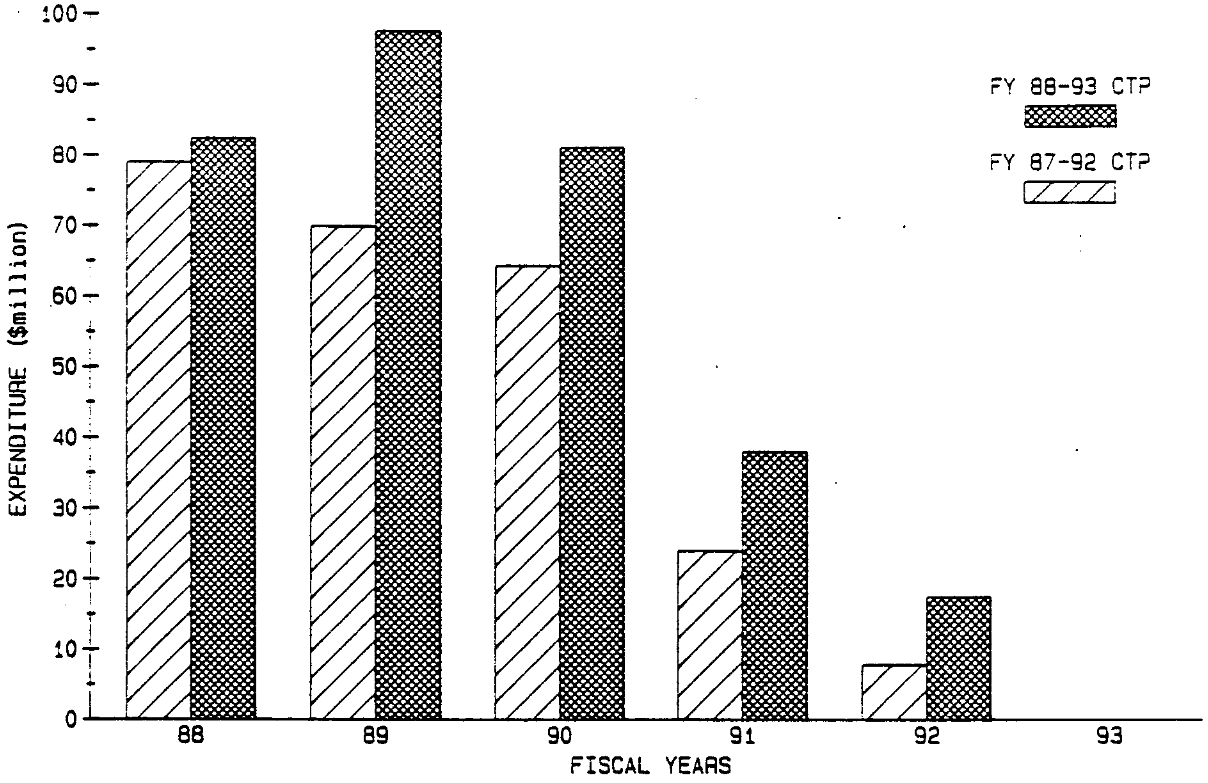


FIGURE 4.5 COMPARISON OF STATE CONSOLIDATED TRANSPORTATION PROGRAMS FOR FY 1987-92 & FY 1988-93

PRIMARY CONSTRUCTION PROGRAM

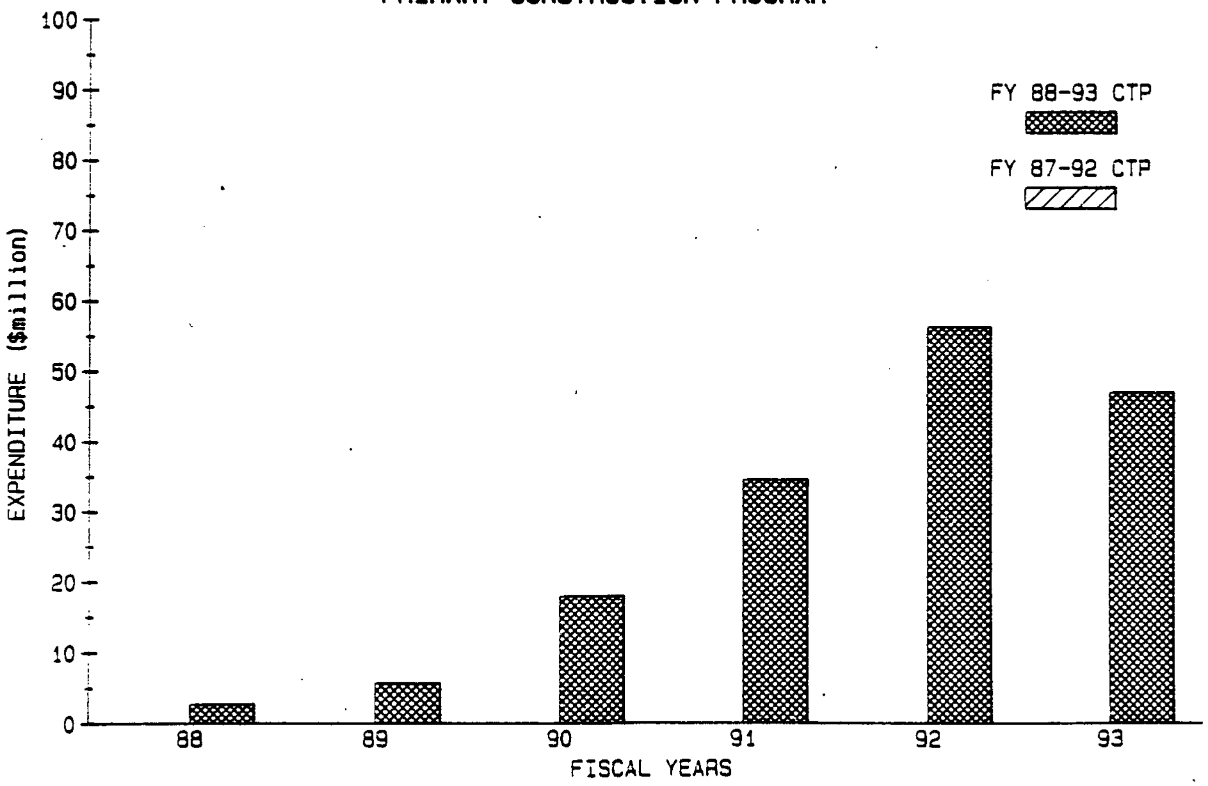


FIGURE 4.6 COMPARISON OF STATE CONSOLIDATED TRANSPORTATION PROGRAMS FOR FY 1987-92 & 1988-93
SECONDARY CONSTRUCTION PROGRAM

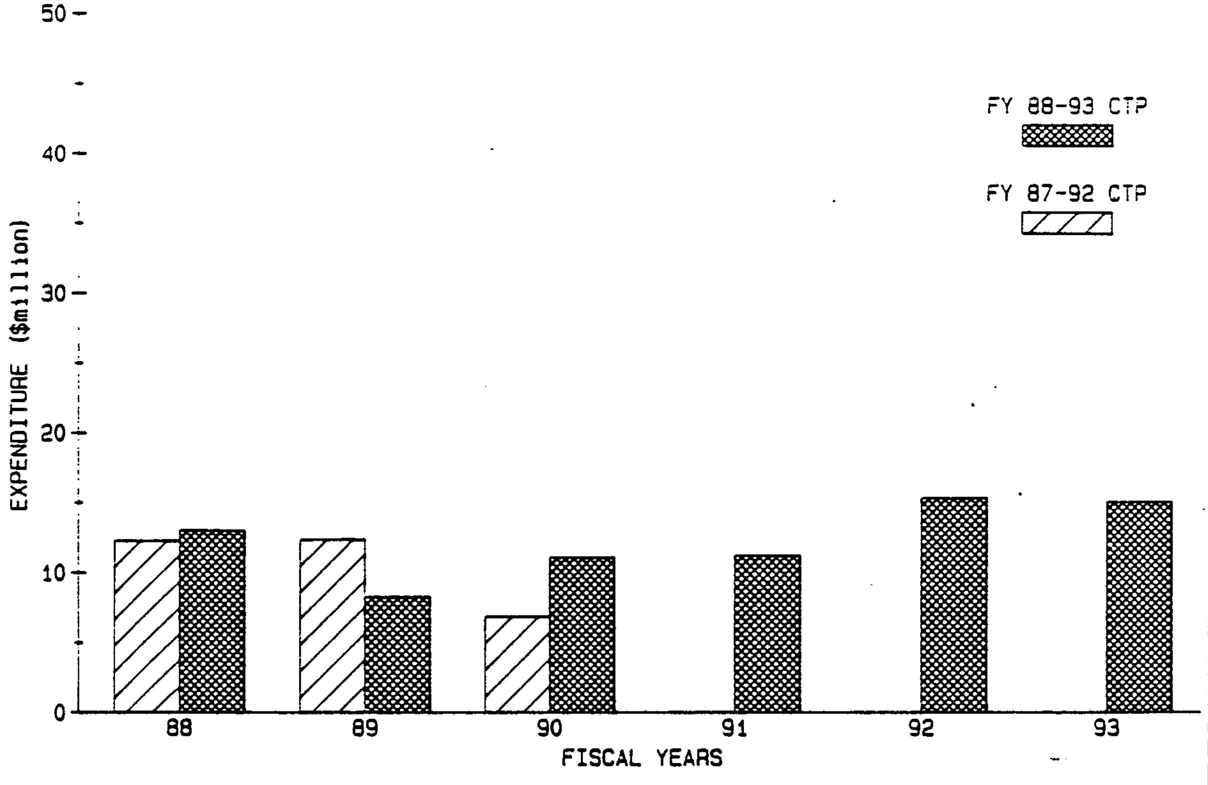
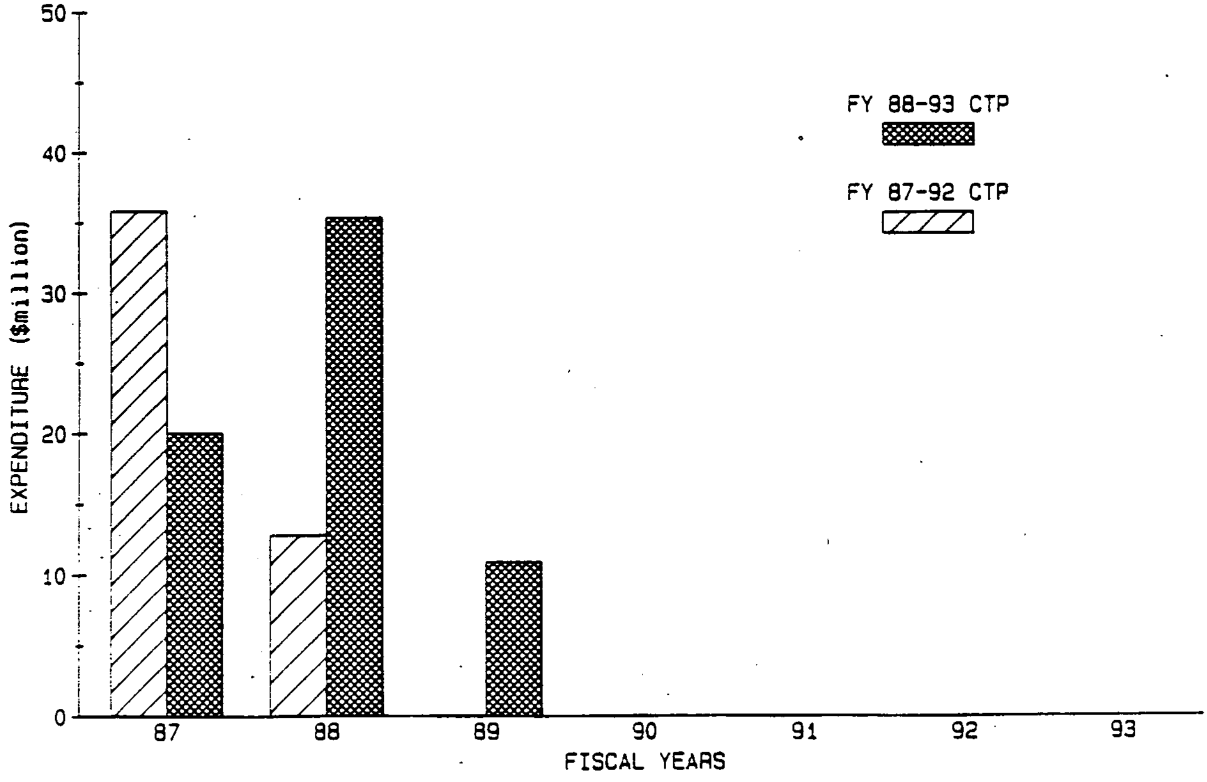


FIGURE 4.7 COMPARISON OF STATE CONSOLIDATED TRANSPORTATION PROGRAMS FOR FY 1987-92 & 1988-93
SPECIAL PROJECTS PROGRAM



south of Damascus. These two projects are of near equal importance and the locally elected officials may want to defer a decision on the priority until the Spring of 1988. Additional information regarding traffic in the Damascus area will be available as part of the SHA feasibility study of the Damascus By-Pass and may be helpful in the determination of whether MD 124 or MD 27 should have preference.

The drafting of the Annual Growth Policy by the Planning Board also presents an opportunity for the Planning Board to give recommendations to the County Executive regarding projects it thinks the Executive ought to include in latter years of the forthcoming CIP. For the past several years, the Department of Transportation and the County Executive have requested both formal and informal input to their preparation of the recommended CIP. The narratives for each of the Policy Areas given in a previous section of this report gave general discussion and recommendations for particular projects in the different areas. Table 4.2 presents a summary tabulation of the recommendations contained in the various Policy Area narratives. It is desirable that the CIP should continue to identify projects which would be scheduled for completion in the fifth and sixth years of the CIP. That will enable succeeding Annual Growth Policy documents to be prepared in an orderly fashion.

Table 4.1

Recommended Priority List for the Initiation of New Project Planning Studies by the SHA

Priority	Project	Limits
1.	MD 124 reconstruction (Gaithersburg-Laytonsville Road)	Mid County Highway to MD 108 (Damascus Road)
2.	MD 27 reconstruction (Ridge Road)	Germantown Drive Interchange with I-270 to south of MD 108 (Main Street)
3.	MD 117 reconstruction (Clopper Road)	MD 124 (Quince Orchard Road) t MD 118 Relocated (Germantown Road)
4.	MD 97 reconstruction (Georgia Avenue)	MD 108 (Olney-Laytonsville Road) to north of Brookville

Table 4.2

Listing of Transportation Projects for Possible Inclusion in the Latter Years of the Forthcoming FY 89-94 CIP

Policy Area	Project	Limits or Location
Cloverly	A. Good Hope Road Safety Project	Cape May Road to Spencerville Road (MD 198)
Darnestown/ Travilah	B. Quince Orchard Road Safety and Relocation Project	Darnestown Road (MD 28) to Dufief Mill Road
Fairland/ White Oak	C. Fringe Parking Lot	Colesville Road (US 29) and Fairland Road
Gaithersburg East	D. Snouffer School Road Widening	Gaithersburg-Laytonsville Road (MD 124) to Warfield Road
	E. Shady Grove Road Widening	Briardale Road to Muncaster Mill Road (MD 115)
Gaithersburg West	B. Quince Orchard Road Safety and Relocation Project	Darnestown Road (MD 28) to Dufief Mill Road
	F. Great Seneca Highway Extended	Darnestown Road (MD 28) to Ritchie Parkway
	G. Shady Grove Road Extended	Darnestown Road (MD 28) to Piney Meeting House Road
North Bethesda	H. Executive Boulevard Extended	Nicholson Lane to Woodglen Drive
Potomac	I. Seven Locks Road Widening	Montrose Road to Tuckerman Lane
Rock Creek	J. Shady Grove Road Extended/Muncaster Road New Road Relocation	Airpark Road to Olney-Laytonsville Road (MD 108)
	K. Shady Grove Road Widening	Airpark Road to Muncaster Mill Road (MD 115)

CHAPTER 5

STANDARDS OF TRANSPORTATION AVERAGE LEVEL OF SERVICE

INCLUDING ESTIMATES OF CURRENT LEVEL OF SERVICE CONDITIONS

CHAPTER 5

STANDARDS OF TRANSPORTATION AVERAGE LEVEL OF SERVICE INCLUDING ESTIMATES OF CURRENT LEVEL OF SERVICE CONDITIONS

A. INTRODUCTION: TWO MEASURES OF LEVEL OF SERVICE:

The question of how well is the County's transportation system working is answered by using a "Level of Service" (LOS) indicator. This indicator is used in two different ways: (1) to measure the specific condition at a particular intersection or segment of a road, and (2) to measure the average condition over an area that includes many intersections and road segments. The methods used to measure LOS at an intersection or segment are more easily understood than those used to measure average LOS over an area. Because the Annual Growth Policy uses the average LOS concept as an important building block in its analysis, the methods used to calculate this measure warrant explanation.

1. Intersection Level of Service:

The concept of intersection or roadway LOS has been used by the transportation engineering profession since the early 1950's. It basically has been a qualitative measure of how well an intersection or roadway is operating. It is a separate concept from capacity which is a quantitative measure of traffic flow. Definitions and measurement criteria have been established to distinguish among the different gradations of LOS. An easily recognizable way to distinguish among these levels has been to use "letter grades" ranging from A to F which are analogous to the letter grading systems familiar to students. In this measurement scale, the LOS A is associated with conditions of least congestion and generally free flowing traffic with safe operating speeds. At the other end of the measurement scale is LOS F which is associated with conditions that represent stop-and-go congested traffic, where there are often forced flow situations and traffic back ups. For a roadway segment, the greatest traffic flows occur at LOS E which is considered as the maximum capacity.

The particular intersection LOS measurement technique used by the Planning Board has been that of the Critical Lane Volume method. This particular technique is outlined in the subsequent chapter on the Local Area Transportation Review. That chapter also gives the measurement scale which distinguishes among the different LOS categories.

The Planning Department has initiated some studies to develop a better understanding of how to measure and depict traffic congestion, particularly for congestion at intersections. Video taping and time lapse filming was carried out in September, 1986 at six selected intersections and for a section of I-270. The presentation video illustrates conditions representative of those different levels of intersection LOS. This video tape was shown

at the Council work sessions on the FY 88 Annual Growth Policy (AGP). The video tape has since been used to explain this concept to interested groups and individuals. Copies of the video are available on loan for purposes of viewing by individuals or presentation to interested groups upon request to the Transportation Planning Division; call 495-4525.

2. Average Level of Service for an Area:

The Planning Board and staff have used the concept of average LOS since it was introduced in the 1979 Comprehensive Staging Plan proposal. Briefly, it was developed as follows.

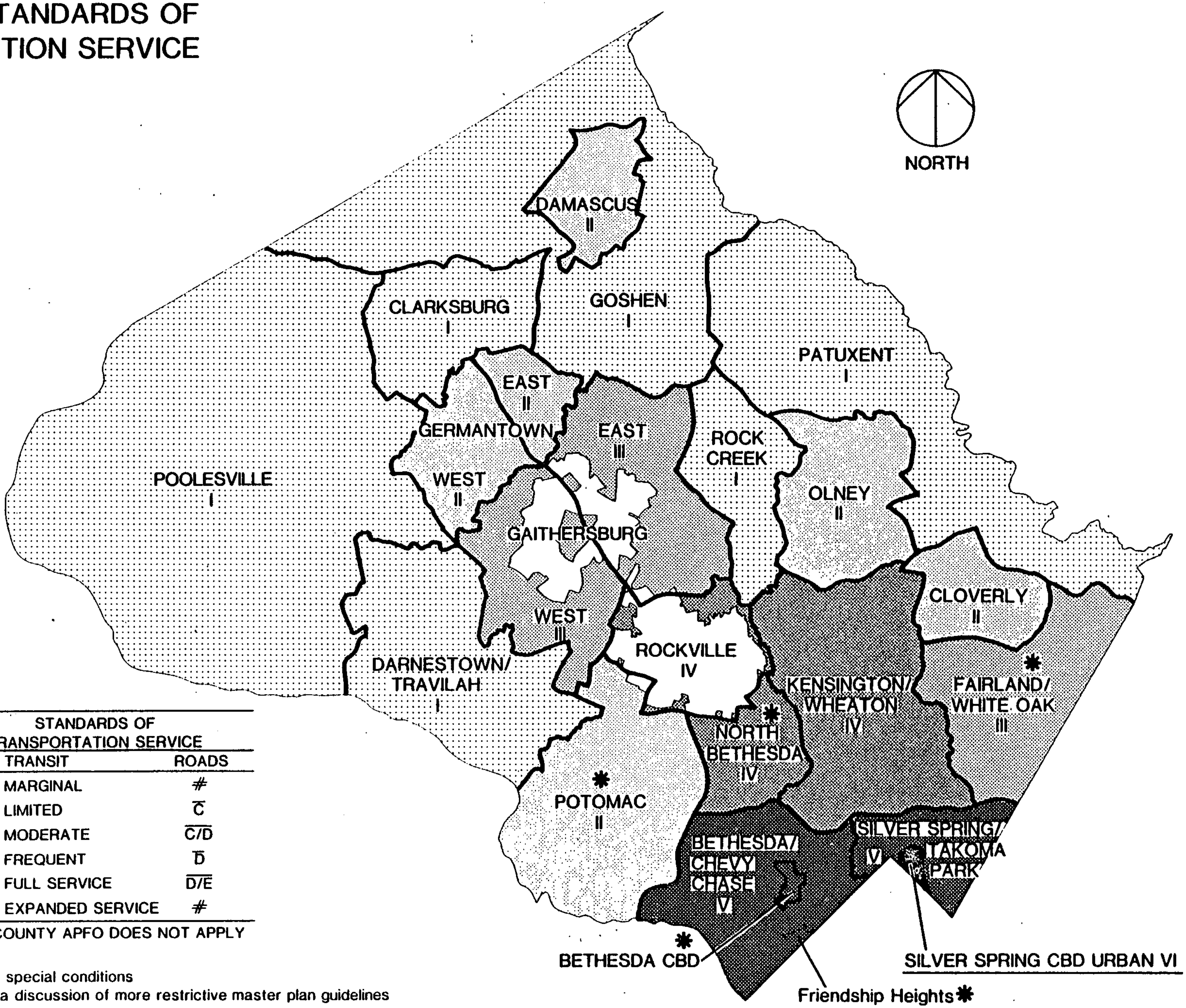
The County has been divided into a number of policy areas which have been used as the geographic units for which average LOS conditions for each area is determined. These policy areas are further organized into six groups based upon the degree of public transportation service available to them. These groups have been subsequently related to the average roadway congestion experienced in those areas. From the point of view of travelers in the County, they usually experience several different LOS conditions at different parts of their trip. Consequently, most people tend to view LOS as an average over many roadway segments and intersections. By comparing observed or forecasted traffic volumes on individual roadway segments to the capacity of those roadways, a quantitative indicator, or ratio, associated with particular LOS conditions is obtained. These ratios can then be aggregated and averaged to describe conditions for an entire area, such as a policy area. The resulting measure is seen as being more representative of the cumulative conditions experienced by many travelers across the entire area, rather than of the conditions at any one intersection or roadway segment.

In addition, most people tend to divert to alternate routes when they encounter congestion, if they have a choice or are made aware of conditions ahead through the various traffic reporting services on the radio. This diversion of traffic also tends to average out level of service conditions over an area.

B. STANDARDS OF ACCEPTABILITY FOR AVERAGE LOS:

Six classes of transit service have been used to group policy areas for the purpose of defining LOS standards, or norms, for roadway congestion. Map 5.1 shows the particular combination of policy areas in accordance with these groups and indicates the acceptable LOS standard for each group. These transportation service standards for average LOS conditions have been revised to reflect a change which added an Urban Group for areas of the County (Silver Spring CBD) that have, among other requirements, at least 100 bus trips during the PM peak hour, a Transportation Management District, and control of parking available within the CBD. The setting of each of these standards is based upon an acceptance of a policy correlation between transit availability

MAP 5.1 STANDARDS OF TRANSPORTATION SERVICE



KEY	STANDARDS OF TRANSPORTATION SERVICE: TRANSIT	ROADS
GROUP I	MARGINAL	#
GROUP II	LIMITED	$\overline{C}$
GROUP III	MODERATE	$\overline{C/D}$
GROUP IV	FREQUENT	$\overline{D}$
GROUP V	FULL SERVICE	$\overline{D/E}$
GROUP VI	EXPANDED SERVICE	#
MUNICIPALITIES:COUNTY APFO DOES NOT APPLY		

See Text on page N for special conditions

✱ See pages 3 and 4 for a discussion of more restrictive master plan guidelines

and average LOS on the roadway network. The specific correspondence used in the Annual Growth Policy is shown in Tabel 5.1. It has been reasoned that as transit service standards decline average roadway congestion standards which are used should provide for less congested LOS conditions. Conversely, as transit service standards increase, roadways, on the average, should be allowed to approach their capacity because people have a convenient alternative to their automobiles.

In effect, these area-wide averages are representative of the dominant congestion conditions experienced by groups of people throughout an area. It is recognized in this average measurement approach that some individual intersections or roadway segments would be operating at LOS conditions worse than the average, while others will be operating the same or better than the average. For that reason, a policy of doing Local Area Transportation Reviews is used to assess whether one or more particular intersection or roadway segment would operate at an unacceptable LOS.

Table 5.1 also provides more detail to distinguish among the levels of transit service used in this Annual Growth Policy Report. Six levels of service transit availability are identified ranging from areas with no direct transit service to areas with full and expanded transit service. More detail on the underlying measures associated with this table are presented in the next chapter on Alternative Measures of Level of Service.

C. MONITORING LEVEL OF SERVICE CONDITIONS:

An important element in the Annual Growth Policy process should be the monitoring of transportation Level of Service conditions and changes in travel behavior due to implementation of traffic alleviation measures. Enhanced monitoring and evaluation efforts will be necessary to provide a positive feedback loop to the policy-making and budget process and to help ensure that traffic forecasts are as reliable as possible.

If the County is to ensure maximum cost-effectiveness of congestion alleviation measures and other transportation system improvements, then more resources will be needed to monitor traffic conditions. This includes monitoring: 1) traffic volumes, speeds and delays, 2) transit ridership, 3) bicycle use, and 4) other quantifiable aspects of peak period travel in the County, such as a) overall mode choice by area, and b) peaking characteristics of travel demand. Current transportation monitoring systems need to be improved in order to meet the needs of this fast-growing urban-suburban County where growth policy is an important public issue.

Counts of traffic on road links and intersections and counts of transit ridership are important information needed to analyze and monitor transportation problems in the County. Such counts are vital to understanding trends in traffic congestion and

TABLE 5.1: CORRESPONDENCE BETWEEN TRANSIT AVAILABILITY AND AVERAGE LEVEL OF SERVICE STANDARDS

Average Level of Service Standards	Group Classifications	Public Transport Alternatives to Automobile Travel	Transit Services Available or Programmed				
			Auto Dependent System and/or	Bus Based Systems		and/or Fixed Guideway Systems	
			Park/Ride Access	Community and Local Bus Service	Regional Park/Ride Express Bus and High Occupancy Vehicle Priority Systems	Commuter Rail or Light Rail	Metrorail
*	I	Marginal	Marginal access to stations or bus routes outside of the area	Not available	Not available	Marginal amount of the area is within walk access	Not Available
$\bar{C}$	II	Limited	Limited number of park/ride spaces	Limited coverage and frequency	Limited park/ride spaces or lots with local bus service	Limited park/ride access and walk access	Park/ride and kiss/ride access limited to nearby stations outside of the area
$\bar{C}/\bar{D}$	III	Moderate	Moderate number of park/ride spaces, limited kiss/ride service	Moderate coverage, service limited to policy frequencies	Moderate express bus service in conjunction with a system of park/ride lots	Moderate parking or walk access with system transfers	Moderate station coverage in the area with associated feeder bus access
$\bar{D}$	IV	Frequent	Moderate park/ride spaces and moderate kiss/ride service	Moderate coverage, combined policy and frequent demand-based service	Priority treatment for frequent express buses, local circulation feeder services in conjunction with a system of park/ride lots	Same as Group III above	More dense spacing of stations and feeder bus routes
$\bar{D}/\bar{E}$	V	Full	Limited park/ride with full reliance on kiss/ride access	Full area coverage and a large number of routes with frequencies based on demand	Same as Group IV above	Same as Group III above	Full frequency and full reliance on kiss/ride, easier walk and bicycle access
*	VI	Expanded	Expanded park/ride with reliance on kiss/ride access	Expanded bus frequencies; 100 buses in PM peak hour	Same as Group IV above	Same as Group III above	Designated CBD; controlled parking; Transportation Management District

* See Text for Method, and Standard of Measuring Traffic.

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improving both road and transit services. In addition to the direct use by the operating agencies, these counts are one of the foundations for the transportation simulation models used by Commission staff in recommending development staging ceilings. These counts are also a basic element in the Local Area Transportation Review conducted as part of the administration of the Adequate Public Facilities Ordinance. Current traffic counts at critical intersections affected by a proposed development are a primary input used in the analysis of local transportation system adequacy. The traffic counts are also the main data input to the preparation of annual update of the map of Annual Average Daily Traffic produced by MCDOT and the newer Inventory of Peak Hour Traffic Volumes now being maintained by the Planning Department.

Travel speed and delay studies are another way to measure the effects that alleviation measures and transportation improvement projects have on LOS or congestion. Speed and delay studies have been performed by a consultant for the Planning Department. From this data it is possible to determine the average travel time along given routes. It is also possible to obtain the average stopped delay for approaches to signalized intersections. After sufficient alleviation measures or transportation improvement projects have been implemented, new speed and delay studies could be performed to determine if the average travel time has changed as a result of the improvement.

The experimental nature of many proposed traffic alleviation measures increase the importance of evaluation efforts. One means of assessing these alleviation measures will be the analysis of changes in traffic and transit counts. However, proper evaluation of most of these alleviation measures will require the collection of new and different types of data other than simple traffic and ridership counts. Periodic travel surveys of households and work sites are needed to identify the effect of traffic alleviation measures. It would be very difficult to determine the effect by simply using traffic counts, since traffic volumes are also affected by new development, new road openings, temporary congestion conditions due to construction, and have substantial weekly and seasonal variation.

One approach for this new data collection would be to institute periodic household and employee travel surveys. They would provide accurate and reliable data and information on interrelated changes in (a) mode choice, (b) trip length, and (c) trip distribution. The trip distribution information should be able to be stratified by geographic areas, by time of day and by trip purpose. These surveys should be done annually as part of the Growth Policy monitoring process. They could provide the means for annual assessments of progress, success, and problems in implementation of the traffic alleviation measures. The surveys that will be conducted for the Silver Spring Transportation Management District may also be of help here.

D. CURRENT TRANSPORTATION LEVEL OF SERVICE CONDITIONS:

For many years, Planning Department staff have been working in cooperation with Montgomery County Department of Transportation (MCDOT) staff to collect, analyze and, tabulate intersection LOS conditions. Starting in 1977, we published the Peak Hour Intersection Level of Service Inventory which provided a tabulation of the then recent LOS conditions. That inventory has been updated since then on an intermittent basis. Recently, we have begun to collect data on delay and speeds which can be used to develop a time series of various other measures of level of service. Alternative measures of level of service are discussed in the next chapter while elaboration of the current level of service conditions is presented below.

1. The Location of More Congested Intersections:

In the past the main way we had to consistently measure congestion at intersections was by calculating the LOS based on the latest traffic count available. Due to the number of intersections to keep track of, and the budget and schedule of MCDOT for taking counts, quite often traffic counts could be as much as three to four years old. A map showing the LOS at congested intersections could not be tied to any one year time period. Therefore, tracking changes in LOS from year to year was not possible. The 1985 update to the Highway Capacity Manual introduced other ways to define and measure LOS along with refining the Critical Lane Volume method. One of the techniques introduced in the new manual is to relate LOS to the amount of delay encountered at a signalized intersection. Table 5.2 relates LOS with intersection delay as outlined in the Highway Capacity Manual.

TABLE 5.2: CORRESPONDENCE BETWEEN LEVEL OF SERVICE CATEGORIES AND THE AMOUNT OF AVERAGE DELAY PER STOPPED VEHICLE AT AN INTERSECTION

Level of Service	Average Stopped Delay Per Vehicle (seconds)
A	less than 5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	greater than 60.0

Source: Table 9-1, 1985 Highway Capacity Manual, Transportation Research Board, p. 9-4.

During a one month period in May and June, 1987, a consultant to the Planning Department made an extensive number of travel time runs on every major road in Montgomery County. From this data it has been possible to estimate the average delay that is encountered for most approaches to signalized intersections in the County. Since the data used was gathered over a short time period, rather than the three to four year time period used in the intersection counting program, the results are more of a "snapshot" of the actual conditions at a brief point in time. By collecting more data on a sample of these roads next Spring it will be possible to compare how conditions are changing.

Map 5.2 shows the LOS for the more congested approaches to intersections for the AM peak hour based on the data collected this Spring. Intersection approaches having LOS D, E, or F are shown. Map 5.3 shows similar information but for the PM peak hour. Table 5.3 summarizes the same information by Policy Area and also includes a tabulation of the number of intersection approaches with D, E, or F LOS for the mid-morning and mid-afternoon periods of the day. A detailed analysis of Table 5.3 shows that there are more intersection approaches with LOS D, E, or F during the PM peak hour than during the AM peak hour. The table also shows that there are more intersection approaches with LOS D, E, or F in Policy Areas where higher highway levels of congestion are permitted. More detail on this inventory is given in Chapter 6 of this report. Traffic counts will still be used to predict LOS related to any specific Local Area Review for any proposed development.

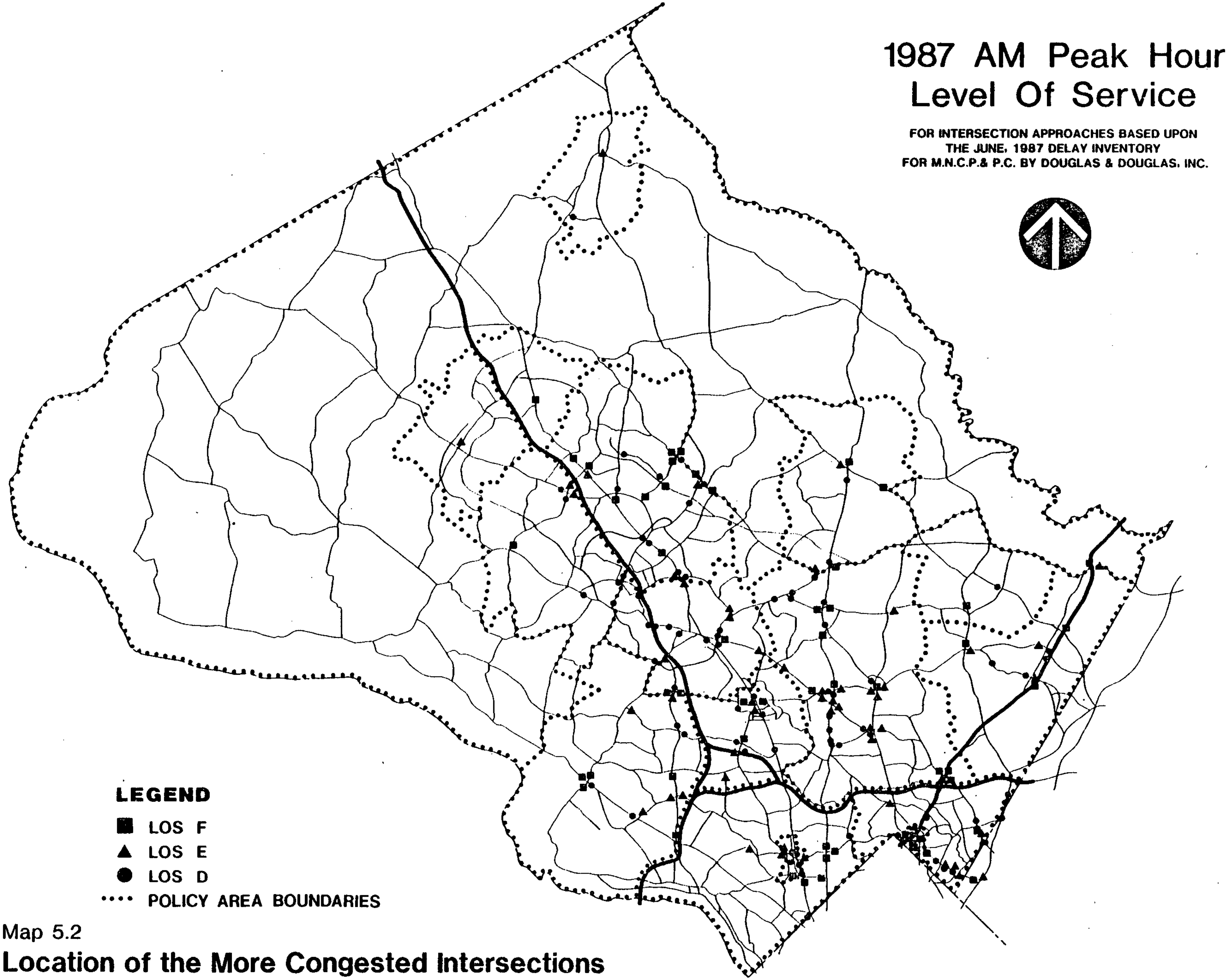
2. <u>An Assessment of Current Average Level of Service Conditions</u>:

As in previous years an effort has been made to estimate the current 1987 traffic conditions expressed in terms of average level of service for each policy area. This estimate was compared with the standard LOS for each Policy Area in the draft FY 89 AGP. The terms "Better", "Worse" and "Same" are used to reflect a judgment about the relationship between current traffic conditions and these standards.

Map 5.4 gives the results of this comparative assessment. It shows that the areas of Silver Spring/Takoma Park, Silver Spring CBD, Bethesda/ Chevy Chase, Kensington/Wheaton, North Bethesda, Potomac and Rockville are estimated to currently have average LOS conditions which are better than, or not as congested as, the transportation service standards for those areas. Damascus, Olney, Gaithersburg East and Gaithersburg West, and Fairland/White Oak are estimated to be essentially at their standards. The areas of Cloverly, Germantown East and Germantown West are estimated to have average level of service conditions that are worse or more congested than their adopted standards. In comparing the estimated average LOS value to the corresponding value of the standard, a criterion of being within plus or minus

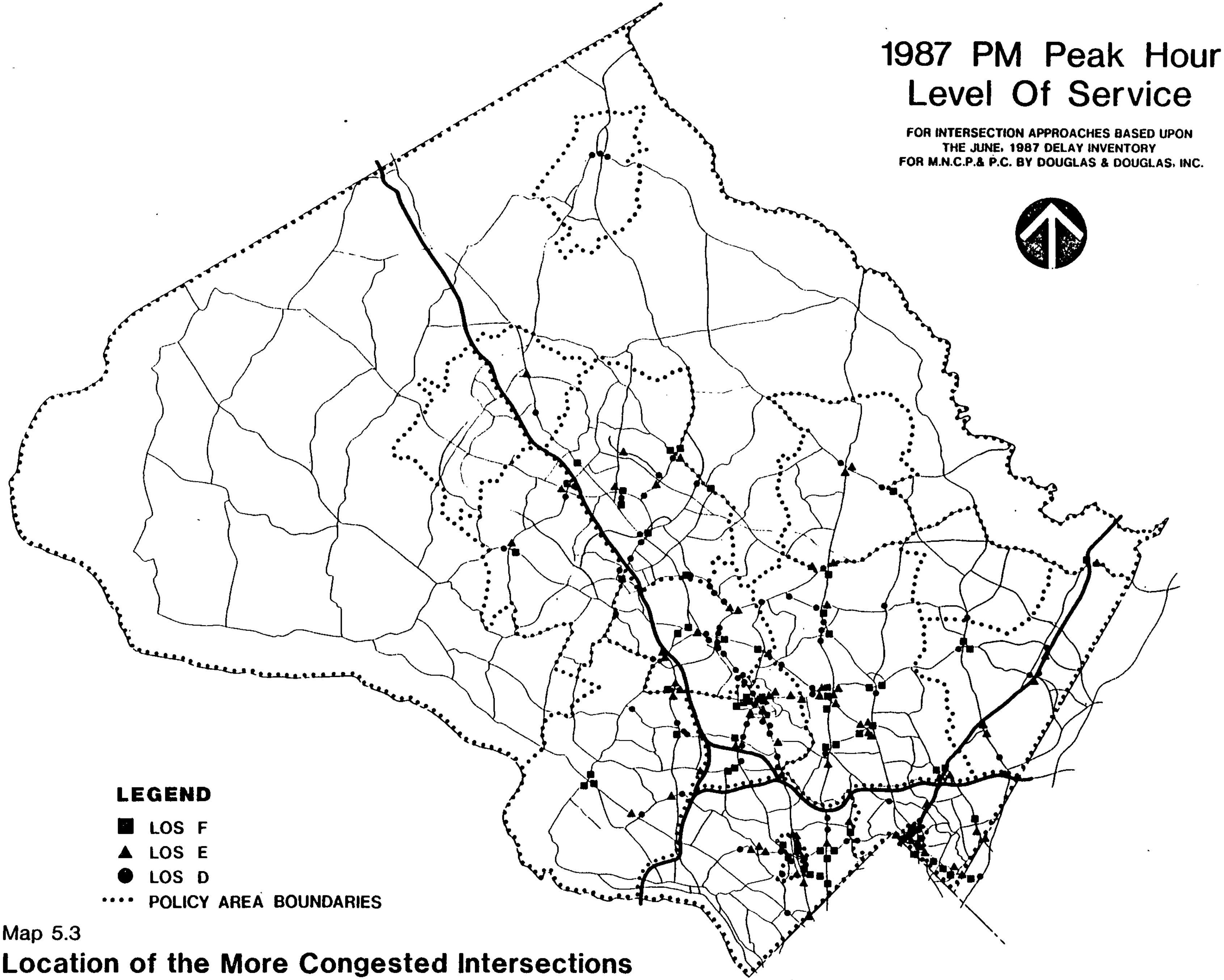
TABLE 5.3: Summary Of The Number of Intersection Approaches by Policy Area And Time Period Operating at LOS D, E, or F Conditions in June, 1987

POLICY AREA	AM PEAK			MID MORNING			MID AFTERNOON			PM PEAK		
	D	E	F	D	E	F	D	E	F	D	E	F
BETHESDA	7	4	7	10	6	4	11	7	5	10	12	14
CLOVERLY	0	0	1	0	0	0	0	0	0	2	0	0
DAMASCUS	2	1	0	1	2	0	1	1	0	2	0	0
GAITHERSBURG EAST	9	4	11	9	3	4	10	4	3	8	4	9
GAITHERSBURG WEST	5	2	1	5	1	0	4	0	0	2	2	2
GERMANTOWN EAST	0	0	0	0	0	0	1	0	0	2	1	0
GERMANTOWN WEST	0	1	0	0	0	0	0	0	0	1	0	0
FAIRLAND/WHITE OAK	4	3	3	3	4	0	7	0	0	7	4	2
KENSINGTON/WHEATON	16	14	11	12	7	1	17	5	2	14	19	14
NORTH BETHESDA	6	4	3	5	3	0	2	6	4	13	4	8
OLNEY	3	1	3	1	2	0	4	2	0	2	3	0
POTOMAC	4	5	9	7	4	1	5	3	2	7	6	7
ROCKVILLE	11	5	2	9	2	1	14	3	0	18	6	5
SILVER SPRING/TAKOMA PARK	10	8	6	9	2	3	7	4	2	9	10	9
TOTALS	77	52	57	71	36	14	83	35	18	97	71	70



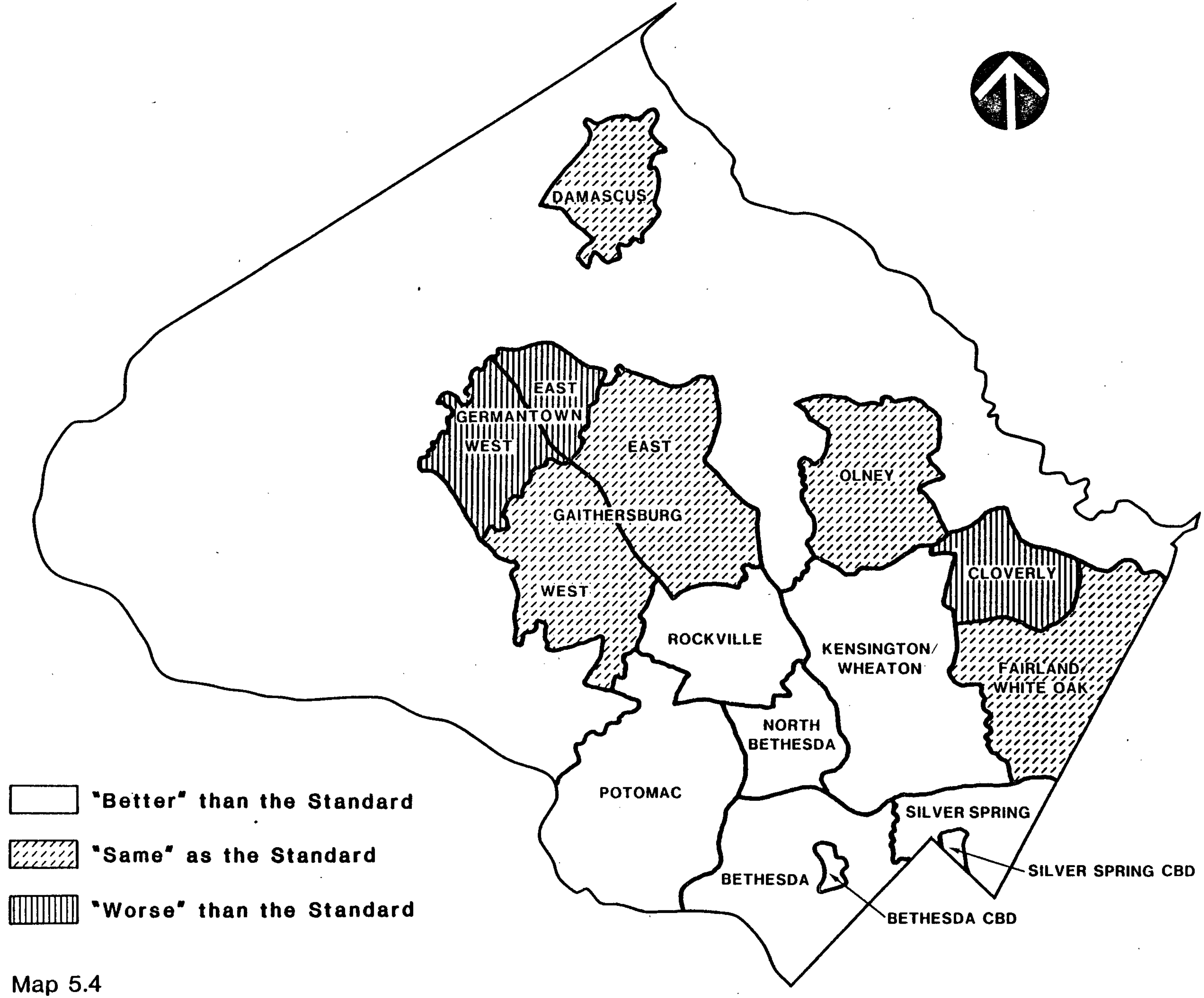
Map 5.2

Location of the More Congested Intersections for the Morning Peak Hour.



Map 5.3

Location of the More Congested Intersections for the Afternoon Peak Hour.



Map 5.4

Comparison of Estimated Current 1987 Average LOS Conditions With the Standard for Each Policy Area

five percent of the standard is used to determine whether the current values should be considered as being the "same" as the standard.

It is important to note that these are average measurements over large areas, and that individual, local "hot-spot" congestion areas can occur within a larger area that statistically meets the standard on an average basis. For example, excess traffic congestion in the Bethesda CBD can coexist with an acceptable LOS average over the entire Bethesda Policy Area. The growth limits placed on the Bethesda CBD are measured separately through the master plan process, at a greater level of detail.

The pattern of current average LOS conditions given in Map 5.4 shows first that the areas which have values which are better than their standards, tend to be the down-County and mid-County areas. The areas which has the same LOS conditions as their standards have had a relatively large number of road projects completed in the past few years, either as Metro access projects or as economic development roads. The areas which have average LOS conditions worse than their standards tend to be the areas at the developing fringe. Those areas are the ones which have been experiencing higher rates of growth in the past few years and for which transportation improvements in the CIP will soon be implemented.

For a discussion of procedures relating to estimating future level of service conditions the reader should refer to Chapter 7 of this report on Modeling Policy Area Level of Service.

CHAPTER 6

ALTERNATIVE MEASURES OF LEVEL OF SERVICE

INCLUDING TRANSIT'S EFFECT ON TRANSPORTATION CAPACITY

CHAPTER 6

ALTERNATIVE MEASURES OF LEVEL OF SERVICE

INCLUDING TRANSIT'S EFFECT ON TRANSPORTATION CAPACITY

A. INTRODUCTION AND BACKGROUND:

The County Council requested that the Planning Board's Draft Annual Growth Policy for FY 89 include analyses and recommendations, with regard to several aspects of measuring level of service (LOS). It was suggested that this work be done to the maximum depth possible within the constraints of time and resources. The previous Chapter presented standards of transportation average levels of service including estimates of current level of service conditions. This Chapter outlines the basic response to the Council's request by adding to the information and ideas given in the previous Chapter. These additions include: 1) a refined basis of setting LOS standards based upon a broader definition of transit availability, 2) a discussion of alternative measures for the average level of service for highways, 3) a review of material that illustrates how different people perceive different levels of service differently, 4) a discussion of the effect of transit service and traffic alleviation measures in providing transportation capacity, and 5) a clarification of how the capacity provided by transit and traffic alleviation measures is being accounted for in the Annual Growth Policy and in the setting of staging ceilings. To the extent possible, reference back to the specific request of the Council is given in the discussion below.

B. REFINED BASIS FOR SETTING LEVEL OF SERVICE STANDARDS:

Part of the Council's request was that there be a *"refined basis for setting a standard of service for each policy area (amount of transit service, density of development, etc.)."* This section first describes some general ideas related to the performance of transportation systems as expressed in terms of the concept of level of service, and then more specifically as they relate to transit service. These ideas have been used in refining the table of transit availability with respect to providing different levels of service. How that measure is combined with an appropriate measure of highway level of service to produce area average levels of service for transportation is considered next. Finally, other factors in selecting standards are identified.

1. Measuring the Performance of Transportation Systems:

The level of service measure of the overall transportation system provides a connection between the system's performance and

people's experiences. We experience travel and traffic congestion both in an individual role and as members of groups. Our perceptions may vary depending upon in which of these two roles we are experiencing the congestion. However, we tend to reach a consensus on the amount of tolerable congestion on the system as part of a group consensus. In our individual roles, we tend to grade the transportation system against our own expectations for it.

The first commonly used LOS grading system in transportation was developed for highway traffic. More recently a method for measuring pedestrian LOS was developed. Very little work has been performed in developing LOS measures for transit, bicycling or for a total transportation system.

The description of generalized traffic flow and transportation system performance can be extremely complex and difficult. Travel and traffic is a dynamic process similar to the ever-changing character of the tides and waves on a beach. We can describe the daily tides, and we recognize that they change by season. The size of the waves and tides varies daily as a function of wind, weather and the phases of the moon; storms create unexpected variations. As a result, it is very difficult to describe succinctly the "average" waves and the height of the tide that we might expect on one particular day if we were to go to the beach. And so it is with traffic:

- we have measured and described in great detail traffic behavior at a single intersection;
- we measure and describe traffic flow along sections of highways;
- we are just beginning to measure and describe traffic flow over a network in a given area;
- we acknowledge and are aware of peak hours and peak periods;
- we also are aware of but not able to predict the existence of accidents and other incidents which change the expected pattern.

Thus, developing a simple, clear description of traffic conditions at one place in the system which generally holds true from day to day is similar to trying to encompass the many moods of the ocean in a simple description. We learned to describe, measure and generally predict the tides in order to meet the needs of shipping companies and commercial fishing activities. Similarly, agencies which provide transportation facilities and services needed to develop descriptions, measures and predictions of the performance of those parts of the transportation system that they were operating.

Agencies which provide transportation facilities or services generally think in terms of capacity and attractiveness; in other words they measure the supply given and demand expected. Concerns generally center around items such as 1) providing sufficient capacity at an "acceptable" service level or 2) providing a facility such as a toll road or transit line which will attract sufficient users to collect some "acceptable" revenue level. From the perspective of the providers of facilities, the measurement of performance is relatively straightforward: a roadway either has sufficient capacity to avoid breakdown or it does not; a transit line or toll bridge attracts enough users to produce the desired revenue level or it does not. Implicit in this assessment is the notion that the users are being provided with an adequate quantity and quality of transportation. In this respect, the concept of Level of Service (LOS) should be the users way of grading the service actually received against their expectation. It should be a qualitative assessment of the system's performance as seen by users rather than the providers of transportation facilities and services.

The transportation provider is interested in the user's perception of the service level because it may determine how the user will "vote", either with dollars or at the polls. In addition government agencies accept an obligation to attempt an equitable distribution of public services and, consequently, use system performance and measures of LOS to determine investment directions. The desire to accurately assess the LOS of a transportation system leads to two challenges. The first is to measure the appropriate performance characteristics of the transportation which is being supplied. The second is to develop a reliable link between those performance measures of the supply with the levels of services associated with demand as perceived by users of the transportation. These two aspects of transportation planning are discussed next.

We can think of LOS as the qualities we place on a trip when describing it to a friend: How long did it take me today? Did this trip take longer than our expectation of how long it should take? Was there any unusual occurrence to explain the delay such as an accident or fire, etc.? Was the entire trip slow or were there problems only in certain locations?

A trip may become so unsatisfactory that people start looking for an alternative route, an alternative time for travel, or, in fact, even an alternative destination. When congestion gets bad enough, people will make changes in their travel patterns to avoid it.

When traffic engineers and transportation planners measure transportation system performance, they are attempting to use quantitative measures to explain the quality of traffic service as experienced by individual travelers. The quantitative measures are not constant but vary in somewhat repetitive and predictable patterns. For example, demand varies throughout a typical week day, normally higher during the peak hours. Demand

also varies from day-to-day during a week. All of us are also familiar with seasonal variations such as the pre-Christmas shopping period.

Measures of system performance are also affected by changes in the transportation system itself as well as by changes in development. For example, increased development can have an impact on the performance of arterial roads, not only through the increased traffic generated by the new development but also through the requirement for more traffic signals to allow entry to new office complexes, retail stores, or housing projects. Thus, increased development along an existing road can reduce capacity for the previous traffic using the roadway through the installation of new signals and a reduction in green time.

It is difficult to identify a generally understood method for estimating the LOS in a specific geographic area. From a non-technical perspective, about as close as we get is when someone concludes that "it is easy to get around" in a particular city. What this usually means is that walking is pleasant, taxi or transit service is plentiful and easy to use, and traffic congestion is at a low enough level that driving is enjoyable. From a technical perspective, we are at the just beginning stages of developing the tools needed to come up with a measurement for assessing overall LOS for a geographical area. This basically involves assessing the LOS of each of the elements of the transportation system and proposing acceptable combinations.

Before we can develop a measure of LOS for an area, we need to have methods to describe and measure the characteristics which will indicate system performance of the different components of the transportation system. Numerous measures have been developed for highways, somewhat fewer for transit and pedestrian modes. Little or nothing has been done for modes other than those three. The next section discusses how the level of service concept can be applied to transit facilities and services.

2. Measuring Levels of Service for Transit:

Some of the main characteristics of transit that have been used to describe the concept of LOS are coverage, route density, frequency of service and basic accessibility. Other operational measures have included directness of service, passenger density on the vehicles, reliability of the service and travel time ratios of transit time compared to auto time. In addition, average travel speed is a significant indicator of bus performance but generally not as significant for fixed guideway service. Although quantifications have been developed for some of these measures, we believe that it is better at this time to use qualitative values to define transit availability for use in the Annual Growth Policy. Once there is more widespread understanding and agreement as to what qualities distinguish among different levels of transit service, then the effort at quantification would be appropriate. Some aspects of the underlying operational measures of transit availability include:

- <u>Coverage</u> generally refers to the amount of a given geographic area, and the activities within it that are provided with service generally through convenient walk access. For service provided thorough park-and-ride access, the definition of coverage becomes dependent upon many more factors.

- <u>Route density</u> traditionally refers to the spacing of transit lines, of station spacing and distances between bus stops. Originally it was of great importance because of the primacy of walking access. Today it is of somewhat less importance because of accessibility of buses and autos to transit stations.

- <u>Frequency</u> of service is of great importance since it determines waiting times and has a major impact on the perception of availability. For example, an hourly frequency is considered acceptable only by those who have no alternative transportation, whereas five-minute frequency is usually considered excellent service since it implies that a transit vehicle is nearly "always" available whenever a person arrives at a bus stop or transit station.

- <u>Accessibility</u> indicates the user's ease or difficulty of reaching the service and, to some extent, the user's independence from other modes. For example, good walking access to a transit service at each end of the trip or good park-and-ride access increases transit accessibility. Diverse factors such as topography, physical barriers or their absence, weather, and the age and health of users also have a bearing on accessibility.

Table 6.1 uses these four operational measures of transit availability discussed above to define a number of different categorical classifications of transit service for different transit sub-modes. Combinations of transit service that provide increased coverage and frequency with higher accessibility closer stations and stops are ranked as defining a higher LOS. Combinations of transit service that provide less coverage, less frequent service, and/or less accessible service with more widely spaced stations and stops are ranked as defining a lower LOS. This table is the basis of a proposed refinement to Chart 1 which has been adopted in the FY 88 Annual Growth Policy. As can be seen by the words used in Table 6.1, the underlying operational measures of coverage, route density, frequency of service and accessibility are used in a qualitative manner to describe and rank order the different transit LOS categorical classifications.

Table 6.1 also provides an expanded description of the correspondence between transit availability and roadway LOS standards. The description of transit services available provides for not only fixed guideway systems but also bus-based

TABLE 6.1: CORRESPONDENCE BETWEEN TRANSIT AVAILABILITY AND AVERAGE LEVEL OF SERVICE STANDARDS

			Transit Services Available or Programmed				
Average Level of Service Standards	Group Classifications	Public Transport Alternatives to Automobile Travel	Auto Dependent System and/or	Bus Based Systems		and/or Fixed Guideway Systems	
			Park/Ride Access	Community and Local Bus Service	Regional Park/Ride Express Bus and High Occupancy Vehicle Priority Systems	Commuter Rail or Light Rail	Metrorail
*	I	Marginal	Marginal access to stations or bus routes outside of the area	Not available	Not available	Marginal amount of the area is within walk access	Not Available
$\bar{C}$	II	Limited	Limited number of park/ride spaces	Limited coverage and frequency	Limited park/ride spaces or lots with local bus service	Limited park/ride access and walk access	Park/ride and kiss/ride access limited to nearby stations outside of the area
$\bar{C}/\bar{D}$	III	Moderate	Moderate number of park/ride spaces, limited kiss/ride service	Moderate coverage, service limited to policy frequencies	Moderate express bus service in conjunction with a system of park/ride lots	Moderate parking or walk access with system transfers	Moderate station coverage in the area with associated feeder bus access
$\bar{D}$	IV	Frequent	Moderate park/ride spaces and moderate kiss/ride service	Moderate coverage, combined policy and frequent demand-based service	Priority treatment for frequent express buses, local circulation feeder services in conjunction with a system of park/ride lots	Same as Group III above	More dense spacing of stations and feeder bus routes
$\bar{D}/\bar{E}$	V	Full	Limited park/ride with full reliance on kiss/ride access	Full area coverage and a large number of routes with frequencies based on demand	Same as Group IV above	Same as Group III above	Full frequency and full reliance on kiss/ride, easier walk and bicycle access
*	VI	Expanded	Expanded park/ride with reliance on kiss/ride access	Expanded bus frequencies; 100 buses in PM peak hour	Same as Group IV above	Same as Group III above	Designated CBD; controlled parking; Transportation Management District

* See Text for Method, and Standard of Measuring Traffic.

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systems and auto-dependent systems. It has been necessary to view transit service availability from the supply side perspective of the transit providers and relate different levels of transit service to the different transit sub-modes. One of the purpose of these refined descriptions is to move closer to a user based description and measure of transit service levels. Such user based measures would describe how a user of transit would achieve different levels of service, irrespective of whether fixed guideway, bus-based systems, or auto-dependent systems or combinations of them are being used. This refined table of transit services available also provides for the category of urban service as adopted by the Council in the amendment to the FY 88 AGP for the Silver Spring CBD.

3. Correspondence Between Transit and Highway LOS:

Table 6.1 also presents the correspondence between average level of service on the highway system and the levels of transit service availability. There are several relationships between highway LOS, transit LOS, pedestrian LOS, and development densities which are determinants of this correspondence. Firstly, there is a direct correlation between development density and pedestrian LOS; our dense, urban centers have wide sidewalks and better designed and operating provisions for crossing streets. In some places we are even going to separate walkways to enhance pedestrian traffic. (There are currently five overpasses or underpass along Wisconsin Avenue and Rockville Pike in the vicinity of different Metrorail stations.) Secondly, there is also a direct correlation between development density and transit service: the higher the density of development, the more extensive the transit service that can be supported. This can be reinforced even more to the extent there is good pedestrian access between the transit stations and stops and places at which people's activities are occurring. Thirdly, on the other hand, there tends to be an inverse correlation between highway LOS and pedestrian LOS. Wide boulevards with high speed traffic are difficult for pedestrians to negotiate. Sidewalks with numerous high-speed drive-way turnouts are equally hazardous. Fourthly, low density, sprawling office development with large parking lots are difficult to serve either by transit or with pedestrian traffic. As a consequence, it is not surprising that we naturally expect highway LOS to decrease as we increase development densities. In other words, as we increase the level of urbanization, the automobile generally becomes more difficult to accommodate while walking and using transit generally become easier for people to do.

This whole section has so far presented a "refined basis for setting a standard of service for each policy area (amount of transit service, density of development, etc.)." To better account for the perspective of transportation users other factors will probably need to be accounted for in efforts at further refinement. Several likely user based characteristics are discussed in the last part of this section of the chapter.

4. Other Factors in Setting LOS Standards:

The above discussion showed how factors such as the amount of transit service or the relative density of development have been the basis for setting transportation LOS standards used in the AGP. The following discussion illustrates how other factors that are related to characteristics of transportation users could be considered in setting appropriate LOS standards. It may be possible in the future to incorporate some of these ideas into the Level of Service concept used in the AGP.

Although we would each like to complete our trips as quickly as possible, we are pragmatic travelers and amend our expectations based on the length of our trip, the purpose of our trip, and the character of the development through which we are passing. For example, the commuter from Montgomery County to downtown Washington, D.C. normally expects to move more slowly than that same commuter would if traveling to Frederick. There are quite a number of factors which come into play in reaching a consensus for an acceptable LOS from the perspective of individual users. The most important ones are the purpose for which the trip is being made, the length of the trip, available alternatives, and their perceptions regarding the location, duration, and cause of the congestion.

a) Trip purpose affects our tolerance for delay. The work trip which is repeated daily is the most important trip under consideration. Generally it occurs during one or both of the peak periods of the day and represents a major expenditure from our personal time and fiscal budgets. Because of the impact on our entire life style caused by the journey-to-work trip, we are more inclined to look for alternatives for this trip purpose, either in the time of day in which we travel or the mode we choose than for any other trip purpose. At the other extreme we have trips related to social or vacation travel where we may tolerate extremely long delays, in part because we are ignorant of the alternatives and can not easily determine options. The weekly rush to the beach in summer is a good example of this tolerance. Returning to the typical weekday commute example, when we are making trips whose purpose have deadlines such as attending meetings or catching an airplane, we are particularly frustrated by delays which exceed our expectations.

b) Total trip length measured either in terms of distance or time has a major impact on our tolerance for delay. For example, if our trip normally takes five to ten minutes and we double the travel time to fifteen minutes, our reaction is not so severe as when a half hour trip is doubled in length to a one hour trip. In the same way a relatively short distance trip with a serious localized intersection delay is more tolerable than a much longer trip involving a series of intersections with excessive delay. It is also possible to reschedule short trips more easily than long ones which add to the frustration with excessive delay on long trips.

c) Alternative travel times and modes play a big part in our expectations for the LOS of the highway system. As the cost and time of commuting increases for a particular distance, the classic pattern is to first look for alternative routes, secondly look for alternative traveling times, thirdly look for alternative modes, and lastly look for alternative home and/or job locations. The search for alternative routes can sometimes lead to the disruption of neighborhood streets of other people, and the search for alternative traveling times leads to a strain on the overall time budget of the traveler. Many commuters would willingly suffer delay if the time were credited to their work schedule, but they are unwilling to exceed their individual limit for travel time taken from their personal time. As a society, we pay for congestion by the time lost for delivery vehicles and people on business travel which results in lower productivity. We tend to be less willing to absorb this productivity drop for the daily commuter traveling from his or her home to his or her job. One alternative to driving to work in congested conditions is to use an alternate mode where time can be spent productively, or at least less stressfully, and more satisfying to the commuter. In many cases, transit, carpool and vanpool riders will tolerate longer travel times probably because some of their time can be invested either productively or pleasurably reading, working or talking to others.

d) The location of delay, its character, duration and cause, tend to play important parts in our perception of the LOS. We consider not only the duration of our trip being made but also which hours are affected by aggregate congestion in an area. A classic case is the type of congestion and delay found in New York and more recently recognized in the Los Angeles freeway system where almost intolerable conditions exist for two or three hours or more at a time. The impact of this kind of delay is important because it precludes a number of options for most people: they can not change the time at which they make the trip without having an adverse impact on either their time at work or their time at home; frequently there are no alternative, uncongested routes available. Finally, when disturbances become pervasive enough, even moving to a new job or home in the region becomes fruitless. The alternatives then are to move to a new region or work at home.

The impact of all these delays are modified somewhat by whether the trip being made is a long trip through the area suffering congestion, a trip to some point within the area suffering from delay, or a small circulation-type trip between two points within the congested area. The characteristics of the trip have a major bearing on whether options are available, both in time and space. They also are reflected in the expectation, for example, of the traveler through Bethesda on his way downtown expects to make a faster trip than the local resident who journeys through Bethesda to the grocery store. People leaving or arriving at an area which has congested traffic will tend to tolerate it more if that is the only way they can get to and from

the area and it only affects a small part of their total trip in time or distance.

One last aspect of delay that tends to affect user perceptions of congestion relates to the underlying causes of the specific delay. Some delay can be termed recurring in that it tends to occur from day-to-day at the same general locations and time periods. As such, people's expectations account for it and they modify their travel behavior accordingly. Other delay is caused by specific non-recurring incidences such as accidents, severe localized weather conditions or equipment malfunctionings. This type of delay can be particularly frustrating to transportation users because they have not allowed for it in their schedules. The more our overall transportation systems operate nearer their capacity, the more susceptible the system will be to pervasive and extensive incidence based delay conditions. It has been estimated by staff of the Metropolitan Washington Council of Governments that about half of the delay condition experienced by travelers on the Washington Beltway is incidence based delay.

C. ALTERNATIVE MEASURES OF AVERAGE LOS FOR HIGHWAYS:

The previous section showed how the measures of transit LOS and highway LOS can be combined to describe an overall measure of the performance of the transportation system. Part of the Council's request for "a highly understandable presentation" of the various service levels reflects the situation that many people have been finding it difficult to understand the particular measure of average LOS for highways being used in the AGP. As such, this section considers alternative measure of average LOS for highways and whether any would be a suitable replacement for the one currently in use, that of the average volume-to-capacity ratio. We continue to conclude that this measure is still the best overall measure to use at the current time. At some point in the future, it may be possible to use measures based upon either travel time or delay as better overall, and more understandable measures of average LOS for highways. This section first identifies several concerns that need to be taken into account in selecting suitable LOS measures and then discusses the relative merits of several alternative measures with respect to those concerns.

1. Concerns in Selecting Suitable LOS Measures:

There are several concerns that need to be addressed in selecting suitable average LOS measures for highways. These include being empirically measurable, predictable using simulation models, and understandable to the general public because the measure relates well to their perceptions. More specifically, these concerns are as follows:

a) Empirical measurability - effective LOS measures should relate to characteristic of highways which can be directly observed and measured in the field; what is generally termed as being empirically measurable. Measurements should also be transferable, that is measurements taken in one location should describe the same phenomenon as identical measurements from another location.

b) Predictability - effective LOS measures must be related to characteristics of the system that we can predict into the future given our available simulation models. In this way as system characteristics change in the future, we are able to assess their implications.

c) Understandability related to traveler's perception - To be successful a LOS measure must be understandable by the lay-person who experiences the traffic environment. Certainly, LOS A as currently measured is understood to be better than LOS F. However, in many cases it seems that LOS E or F is inadequate to describe fully the delays and congestion which are actually experienced. It is also desirable for a LOS measure to be perceptually consistent. The difference in travel experience between each grade should be in some orderly fashion, although not necessarily linear. For example the decibel scale used to measure noise is logarithmic--a ten decibel increase is heard as a doubling in loudness.

2. An Assessment of Alternative LOS Measures for Highways

Highway LOS is expressed using numerous measures, many of them not capable of being directly experienced by the traveling public. For example, volume to capacity ratios and the density of vehicles along a highway are measures which probably are not well perceived by drivers. On the other hand, two measures of highway system performance which would seem to be easier for the general public to relate to are travel time and delay, both of which include the incidence and amount of time being stopped.

Table 6.2 presents an assessment of four alternative average LOS measures for highways. This table summarizes how we have assessed them with respect to two main evaluation factors: 1) how good is the technical ability to measure and predict the LOS measure, and 2) how easy is it for the measure to be understood by the general public. It is possible to elaborate on this assessment table to differentiate further among the evaluation factors and to consider additional alternative measures.

a) Volume to capacity ratio is the most widely used method for assessing highway LOS especially for corridors and areas. It is also the current measure used in the AGP. It is based primarily upon the measurement of traffic volumes, and then comparing those to an estimate of the capacity of the highway. We have a good technical ability to empirically measure traffic volumes and to predict them using simulation models. However, one difficulty is that the ratio is moderately understandable to the general

Table 6.2: A Summary of the Assessment of Alternative Average Level of Service Measures for Policy Areas

Alternative Average Level of Service Measures for Policy Areas	Evaluation Factors: Technical Ability to Measure and Predict (good-fair-poor)	Evaluation Factors: Understandability by the General Public (easy-moderate-difficult)
1. Average Volume to Capacity Ratio (Current Measure)	good	moderate
2. Travel Time	fair	easy
3. Vehicle Delay	fair	easy
4. Average Queue Length	poor	moderate

public. At the upper end of the scale at LOS A of free-flowing traffic, there is broad agreement and understanding. Unfortunately, as LOS declines there is less agreement on the gradation of different service levels. At the most congested level of LOS F, there is a fair amount of disagreement on whether the measure is broad enough to fully capture the essence of that service level. The capacity component of the ratio has varying degrees of specificity depending upon what underlying definitions are being used to describe the concept of capacity and what particular techniques or data sets have been used to measure the appropriate levels. Even with these shortcomings, the volume to capacity ratio still appears to be the best current measure. This is mainly due to the good degree of confidence in the overall ability to develop and apply specific operational techniques to measure and predict volume to capacity ratios.

b) Travel time - has the benefit of being relatively easy to understand. Our technical ability to empirically measure it is good at the present time but our technical ability to predict it is only fair, hence that overall rating. This is mainly because transportation models are generally calibrated against volume rather than travel time, as has been the case with both the TRIMS and EMME/2 models used in the AGP analysis. If the new EMME/2 transportation model can be successfully calibrated against recently observed travel times, then travel time would seem to be a likely replacement measure of average LOS for highways for use in future AGP's. It may also be possible to better relate the travel time measure to the overall trips of individual users to and from a given geographic area for both measured and predicted conditions.

c) Vehicle Delay is easy to understand by the public in general. Our technical ability to empirically measure it is good, but given the state-of-the-art of simulation models, we have only a fair ability to predict delay on a system-wide basis. This is because delay is generally calculated from the volume to capacity ratio, and at the lower levels of service the ability to accurately predict delay declines. In addition, there are many causes for delay which adds to the complexity of using it as a service measure. For example, certain delays are systemic in that they result from the way in which the system is operated, such as whether traffic signals are coordinated. Other delay is accidental and the result of random, spontaneous events, such as double-parked vehicles, fire and rescue vehicles, traffic accidents, etc. These different causes of delay are not always perceived easily by the general public. It may be possible to develop some predictable system and area measures of delay with the new transportation model and by using the recent inventory of delay and travel times. It may be also possible to measure and predict cumulative delays from a user perspective of trips going to and coming from a given geographic area. Therefore, delay would also seem to be a likely replacement measure of average LOS for highways for use in future AGP's.

d) <u>Average queue lengths</u> are moderately easy to understand by the general public. While the technical ability to empirically measure queue length is fair, the technical ability to predict queue length on a system-wide basis with current simulation models is poor, and hence the overall rating. At a local level, queue lengths are somewhat predictable by using complex micro-scale simulation models of traffic flows as has been done in recently analyses associated with the FY 88 AGP Amendment for the Silver Spring CBD. The use of average queue lengths as a measure of overall LOS in an area is further hampered by the relatively narrow point focus. For example, average queue lengths will tell you whether you have enough toll collectors at a toll bridge or whether signal phases are set properly for a single signal. It tends to be less useful in describing the general LOS in an area and hence is only moderate in its perceptual consistency. The use of average queue lengths in Local Area Review is only just beginning to be used and at this time there is only a fair degree of confidence in the current operational measures.

3. <u>Identification of Additional Alternative LOS Measures</u>:

There are several other alternative measures that could be used to describe average LOS conditions for highways. Included those are: a) average speed, b) the number of vehicles-in-motion on a defined part of the highway network, c) the density of vehicles on the highway system, d) the number of stops and e) an index of user satisfaction based upon relative speeds of different modes for different trip lengths. While these measures have been reported on in transportation planning and engineering literature, they are not discussed here because they currently either have a poor technical ability to predict them or it is felt that they would be moderate or difficult to understand by the general public. However, additional research or tracking of some of these measures in the literature is nevertheless warranted.

D. <u>VARYING PERCEPTIONS OF LEVEL OF SERVICE CONDITIONS</u>:

Part of the Council's request was that *"the growth policy needs to be based on a highly understandable presentation of the real-life meaning of each service level (amount of delay, resulting intrusion of traffic into residential neighborhoods, etc.)"* This section first discusses one of the dilemma's that needs to be accounted for in any presentation of Level of Service; that is, different people perceive different Levels of Service differently. A review is then presented of recent research conducted by Planning Department staff that has attempted to objectively measure and illustrate this subjective phenomenon.

1. <u>Peoples Perceptions of Highway Level of Service Condition</u>:

How individuals perceive an objectively measured level of service they are experiencing varies subjectively from person to

person. As such, the level of service that is tolerable to person A may be different from that tolerable to person B. This can be illustrated by an analogy to weather and human physiology.

Traffic congestion and personal tolerance levels of it are similar to people's response to temperature changes. Each person has a personal tolerance level to different temperatures although most people agree about extremes of hot and cold (in our case, the extremes are free-flowing traffic and complete stand-still). Comfortable temperatures may range from 65 to 85 degrees Fahrenheit. Our tolerance varies by the season and by our expectation of what the temperatures should be and for what temperatures we are prepared. On the 4th of July on the Mall, we expect and accept both high temperatures and tremendous traffic congestion. At the same time we deal with ranges of temperatures on a daily basis (similar to fluctuations in traffic levels by peak and off-peak periods) and describe good and bad climates by averaging temperatures over long periods of time for a given geographic area.

As we make trips, we are aware of disruptions, delays, overall travel time and a general sense of comfort. As with weather, we change our actions in response to weather reports or based upon our perceptions and experience. We also are aware of parking costs, and if we use transit, waiting times, walking times, fares and the number of transfers. We frequently compare the sum total of our driving experience with our real or imagined experience using alternative modes (including carpools) and then arrive at some modal choice. Although we may only use one of the modes, in effect each of us in our travel behavior assess the level of service of the entire transportation system before making a trip. This is analogous to deciding whether to walk to work or carry an umbrella or make a particular trip depending on current or expected weather conditions.

Because the highway system represents such a major component of the transportation system, we tend to focus on its LOS. Even here, the established LOS framework which is based on performance measures seems not to cover the full range of peoples' perceptions. Increasingly, we seem to encounter congestion levels and delays which are significantly longer than the defined value for LOS F, the most congested service level. Some people suggest inventing more levels of unsatisfactory LOS (such as LOS G & H, etc.). The use of the term "gridlock" has become popular even in areas where traffic is not at an absolute standstill or "locked" and where there is no "grid" pattern. In the suburbs the use of that new term is usually applied to traffic flows where the delay is inexplicably long or at least the causes are beyond the driver's range of vision.

2. <u>Research on Measuring and Illustrating Highway LOS Conditions</u>:

Planning Department staff, with consultant assistance, have conducted three research studies that have attempted to more

objectively measure and illustrate highway LOS conditions. While they are referred to briefly in the previous chapter, they are also discussed here with respect to the issue of how different people perceive different level of service conditions differently.

a) The Video On "Understanding Traffic Congestion": Videotaping and time lapse photography was done last year that resulted in a video that gave a highly understandable presentation of the different levels of service. Copies of the video are available on loan for purposes of viewing by individuals or presentation to interested groups upon request to the Transportation Planning Division; call 495-4525. The video illustrates: 1) causes of vehicle delay, 2) resulting traffic queues, 3) time-lapse movies to show different level of service conditions, and 4) an example of the functioning of the level of service technique used in Local Area Review analysis. This research study and video was done partially in response to one of the recommendation of the Citizen's Technical Advisory Committee in their 1982 review of the APFO guidelines; to explore whether calculated LOS at certain intersections are consistent with LOS as perceived by different people.

The sequence of time-lapse pictures shown in the video clearly illustrates a feature of traffic that contributes to different people perceiving even the same level of service conditions differently. The video showed that while certain traffic movements were experiencing extremely congested LOS F conditions, other vehicles passing through the intersection at the same time were traveling in relatively non-congested conditions. In other words, two motorists approaching the same intersection from two different directions can very easily experience very different levels of congestions. It is not surprising therefore to hear discussions among individuals in the general public describing contrary experiences; Person A says "I go through that intersection all the time and it is really congested," while Person B says, "That can't be true, I never have any problem driving through that intersection."

One obvious solution to this type of situation is to talk about LOS conditions based upon the direction of traffic flows. The new Inventory of Delay and Travel Times and the new EMME/2 model both are beginning to better account for directional traffic flows. The previous Peak Hour Level of Service Inventory empirically observed a composite valve of LOS for the intersection as a whole. The previous TRIMS transportation model predicted LOS for each link based upon the sum of traffic flow in both directions rather than accounting for each direction separately as is now being done with the new EMME/2 model.

b) Peak Hour Travel Time Study: In the fall of 1986 an exploratory study was done to empirically observe a sample of travel times and delays in various parts of Montgomery County. The previously published results are contained in Appendix A of this report. A series of maps are given showing travel times to

and from several activity centers during the AM and PM peak hours of travel. By examining these maps, one can begin to get a better appreciation of average LOS conditions for different areas. For example, having some areas with more closely spaced "contours" is an indication that traffic on the average is experiencing slower and more congested conditions than areas where contours are more widely spaced. The discussion in the immediately preceding section regarding the directionality of congestion is also illustrated in the series of maps given in Appendix A. For several areas of the County one can see differences in congestion in the same area depending upon whether traffic is moving in the peak or non-peak direction. One example can be seen by first looking at the Germantown area for travel times to Germantown in the AM for the non-peak direction and, secondly, by then by looking at the same location on another AM map, the one "to Bethesda" for instance, which shows the congestion in the peak direction in the Germantown area.

c) <u>The 1987 Inventory of Delay and Travel Times</u>: In May and June, 1987, an inventory of delay and travel times was conducted throughout Montgomery County. Field crews drove over 25,000 miles collecting data on distances, travel times, and causes of delay during the morning and afternoon peak hours as well as during off-peak hours. Summary maps of the some of the results showing intersections with approaches operating at LOS D, E, or F were given in the previous chapter. Detailed examination of those localized LOS conditions on larger scale maps and by examining the data base, again shows that the LOS conditions again vary according to the direction and time period during which a traveler is approaching a particular intersection. The data base resulting from this inventory has so far only just begun to be analyzed for various information to both describe current LOS conditions as well as provide a base for further refinements of the new EMME/2 transportation model system.

E. TRANSIT'S EFFECT ON TRANSPORTATION CAPACITY

The last part of the Council's request relates to the degree to which transit and alternative transportation relieves traffic congestion, and how any such benefits should be allocated. Part of the request was stated as *"there should be an in-depth evaluation of the extent to which expenditures on transit and alternative transportation can relieve peak-period automotive congestion."* While this sounds like a simple and straight forward enough question, we believe that it misses the more central issue. It is not a question of does transit reduce congestion? Rather, the more important issue is, do new transit services and traffic alleviation measures provide usable transportation capacity to serve job and household growth? Our basic answer is yes with regard to transit service, but the case is still out with regard to traffic alleviation measures.

Perhaps one can make a convincing case that we can expect to achieve small and even negligible reductions in traffic congestion

as a result of our investments in transit facilities and services. One of the main reasons such a result could be found stems from the generalization that traffic, like water, tends to seek its own level. What frequently happens is that vehicles, removed from traffic by people who switch to transit as a result of new transit facilities or services, are very shortly replaced by drivers of other vehicles who change the timing or route of their trip. While the net result of the new equilibrium may be about the same level of vehicular congestion in the peak hour, the capacity of the overall transportation system has nevertheless been increased to the degree to which the new transit facilities or services are being used. That capacity can be appropriately used to serve new development while still maintaining the same approximate level of service on the highways.

There is a very big difference between traffic congestion and traffic capacity. Congestion is a measure of the relative performance of an element of the transportation system which has a given capacity. For example, while a two lane roadway and a four lane roadway can each have the same congestion level, the larger road will nevertheless have twice the capacity, everything else being equal. Applying the same idea to an area, if the congestion level was at a standard such as being used in the Annual Growth Policy for two different areas, then the area having the network with the larger capacity could have a higher development ceiling and yet both areas could have an acceptable level of service. In a similar fashion the same basic situation can prevail for a new transit facility. A given area can have its roadway network operating at its standard of acceptable traffic congestion. If a new transit facility was to be added, then an amount of additional staging ceiling can be determined that will maintain the same level of traffic congestion based upon the degree of use of the new transit facility. In other words, transit facilities and services can provide usable transportation capacity to serve job and household growth.

Conceptually, Traffic Alleviation Measures such as those discussed in considerable detail in Chapter 2, could also indirectly provide increased capacity for new development while maintaining the standards of average level of service. Generally speaking, however, the anticipated effect on development capacity of any particular traffic alleviation measure has been viewed as being small compared to the capacity of a major new road or transit facility. As such their effect on people's travel behavior are viewed as being less certain. It is expected that this might be the case even more over long periods of time.

Language in the FY 88 AGP accounts for this situation. In part A(1)(C) on "Amendment of Policy Ceilings," it is stated that:

> "The effect of the various traffic alleviation measures approved under the 1986 Interim Growth Policy (i.e., short-term traffic alleviation measures) has not been included in the development of the policy area ceilings. If measurable

results become evident, consideration could be given to revision of the ceilings."

The proposed budget for FY 88 of the Planning Department outlined an initial work effort that would be needed for monitoring the effectiveness of traffic alleviation measures. That request for approximately $100,000 in professional services and the extra staff time was not made part of the approved budget. A small scale sample of household travel behavior done cooperatively by COG and the Planning Department could provide a partial base line for the more complete surveys that will still be needed to obtain measurable results of the effect of traffic alleviation measures.

F. <u>REAFFIRMATION OF HOW TRANSPORTATION CAPACITY IS ALLOCATED TO STAGING CEILINGS</u>:

The remaining part of the Council's request was stated as *"to the extent that such relief is found to be a reality* (transit relieving congestions) *there should be recommendations on how far the resulting benefit should be reaped in the form of improved traffic flow, and how for in the form of increased traffic-generating development."* The basic response to this is that given the definition of staging ceilings in the AGP, the resulting benefit from any new transportation facility capacity, whether it comes from roads or transit facilities will always be applied to increasing the staging ceilings. However, as discussed in the preceding section, with respect to traffic alleviation measures the current policy is to apply all the benefit to improved traffic flow with the exception of the Silver Spring CBD area.

The definition of staging ceiling in the AGP is given as "the maximum amount of land development that can be accommodated by the existing and programmed facilities serving the area, at an assigned level of service standard." If a new transit service provides additional transportation capacity to an area, then according to the definition of staging ceiling, a new ceiling would be estimated which would maintain the average level of service at the assigned standard. In effect then, all of the benefit of the capacity of the new transit service would be credited in the form of increased traffic-generating development.

If one were to take the position that the added capacity of a new transit service should be allocated to improved traffic flow, then in essence what is being said is that the assigned level of service standard has not been set correctly. If one is interested in having improved traffic flow, or a better or higher level of service standard, then it becomes independent of whether or not there are additional transit facilities. All that needs to be done is for the Council to assign a better standard to the area and to appropriately lower the staging ceilings. As long as the approved pipeline were still below such a lowered staging ceiling, then the future average level of service conditions should not exceed that better standard.

CHAPTER 7

MODELING POLICY AREA AVERAGE LEVEL OF SERVICE

CHAPTER 7

MODELING POLICY AREA LEVEL OF SERVICE

A. INTRODUCTION AND BACKGROUND:

The interactions between transportation and land use reflect the behavior patterns of people. These interactions and behavior patterns have been observed for many decades throughout the United States and in many other countries. When looked at broadly and quantitatively in a metropolitan area, the collective patterns of people's interaction can be seen as being repetitive and is therefore generally predictable. Effective growth management here in Montgomery County requires 1) an understanding of the current interactions and patterns for the Washington region and 2) the development of planning tools for modeling them.

Since the 1950's and 1960's regional planning agencies have been devising computerized transportation models of daily traffic for their regions. Computers have been needed to manage the large amount of data and calculations related to the forecasting of traffic. These forecasts are usually based on detailed estimates of the locational pattern of future households and jobs and assumed future transportation networks and services. The level of mathematics used in the modeling is generally quite basic, usually simple algebraic statements understandable to most people with high school and college educations. The large amounts of data being handled in the calculations, the many steps involved in linking parts of the models, and the use of jargon have often given the impression that these models are exceedingly complex. While the models may be thought of as complex in that they are constructed of many parts, we believe that with the investment of some time and effort they should be easily understandable by the average Montgomery County resident. This chapter has been written with that in mind.

Following the adoption of the Adequate Public Facilities Ordinance (APFO) in 1973, the Planning Department staff of the M-NCPPC worked with consultants to set up a regional computerized transportation modeling system for Montgomery County. This system used a model from the Metropolitan Washington Council of Governments (COG) called TRIMS that was modified to focus on Montgomery County within the context of the whole region. This TRIMS model system has been used since the later part of 1970's by the Planning Department staff as a tool to help estimate the short-term development capacity of policy areas for residential and non-residential development given: (1) information on programmed transportation facilities from the State and County Capital Improvement Programs (CIP), and (2) policy standards for acceptable levels of traffic congestion. There are separate chapters in this report that deal with those two subjects.

In 1982-83 the Citizens Technical Advisory Committee (CTAC) spent many months reviewing, among other things, the modeling

system. They found that while the modeling system was basically sound, efforts should be directed towards further enhancements, particularly in better accounting for: (a) public transportation, (b) intersection capacity, (c) differences in trip generation rates between up-County and down-County locations, and (d) in the means used for displaying and managing the data inputs and model outputs.

In 1983 work was initiated at model development to upgrade TRIMS in response to the CTAC comments and to devise supplementary software to extend its utility to master planning applications. In 1985 Planning Department staff came upon the EMME/2 model software, which offered promise to be more responsive to the CTAC concerns and solve many of the problems still faced by the TRIMS modeling structure. A decision was made to replace the TRIMS based modeling system with this newer state-of-the-art computer transportation modeling technology. The new M-NCPPC EMME/2 modeling system now serves as the planning tool in the draft FY 89 Annual Growth Policy to estimate future policy area average levels of service and help establish desirable staging ceilings for housing units and jobs.

This chapter starts with an overview of the new EMME/2 modeling system as well as with an overview of how the transportation model works in general. The next part of the chapter focuses on the key differences between the old and new models. Finally, information is then presented on the degree to which the new model has been calibrated against various observed data sets.

B. THE NEW EMME/2 BASED MODELING SYSTEM:

The new EMME/2 based computer transportation modeling system offer many improved features when compared to the older TRIMS based system:

- a state-of-the-art method for estimating how traffic distributes itself on the road network (called equilibrium network assignment) as opposed to the older and less rigorous method used in TRIMS (called iterative capacity restraint highway assignment).

- stronger capabilities to model the effects and use of public transportation, as opposed to the weaker capabilities of the TRIMS system in this area. (Model development activities are still underway on this aspect of the system.)

- informative computer graphics display and interactive graphic network editing capabilities not available with TRIMS.

- greater flexibility for data management, transportation demand model development, and the creation of additional programs to summarize the model results, as

opposed to the cumbersome mainframe computer database procedures used with TRIMS.

o the benefit of operating on a user-controlled microcomputer -- an HP-9000 -- rather than on a remote mainframe, eliminating many problems with program support, data communications, and seemingly arbitrary changes in data processing shop procedures that would sometimes cause days of delay in work.

In using EMME/2, the Planning Department staff sought to incorporate many of the more advanced state-of-the-art computer transportation modeling technology. To gain maximum benefits from this new technology, staff decided to design this new transportation model system to simulate the AM peak hour traffic volumes and congestion condition experienced by the public. In contrast, the old TRIMS system simulated daily traffic flows and then used widely accepted but relatively crude methods to estimate from these daily flows a composite peak hour congestion level.

Modeling AM traffic conditions is far easier than modeling PM conditions. This is because of (1) the much higher portion of work trips made in the AM than in the PM, and (2) the scarcity of current data on non-work travel behavior which occurs in higher proportions in the PM. Further work will be done in FY 88 on modeling PM conditions. While posing greater challenges, the newer peak hour model approach offers several key advantages over the old daily traffic model approach.

o Changes in the way traffic spreads itself out over the day (the degree of peaking), which changes over the years due to both urbanization and increasing congestion, can be readily modeled.

o The results of the traffic modeling simulation is more representative of what people encounter commuting to work, rather than a more abstract composite of both AM and PM peak congestion produced by daily models. The modeling of the AM peak hour traffic replicates the observed directionality of traffic flows typical of almost all roads. Daily assignments factored to represent composite peak period conditions with balanced directional flows often mask errors in network coding and trip table characteristics due to their ambiguous nature. Indeed, the coding of the peak hour network for Montgomery County graphically revealed several ways to improve the representativeness of the previous capacity coding of the road network.

o Directional capacity of roads with reversible lanes, uneven directional capacities, and one-way roads can be directly represented.

o The use of this directional capacity can be more directly estimated for more sensitivity to policy

choices related to this, such as in seeking the appropriate balance between jobs and housing.

The installation and calibration of the new EMME/2 model system has required more time and resources than originally anticipated, especially in the refinement of traffic count data for the calibration and in coding the description of the transportation networks. The switch from a daily traffic model to peak hour model required the assembly and cleaning of a huge data base of AM and PM peak hour intersection turning movement traffic counts. These count data had been collected by the County Department of Transportation over the past 15 years and was previously stored in only handwritten form. This database was needed to verify the modeling of peak hour traffic conditions. This database will be supplemented by new data on observed peak hour traffic delay and speed conditions and household travel behavior recently collected by the Commission and COG.

C. AN OVERVIEW OF HOW TRANSPORTATION MODELS WORK:

1. Analysis Context:

Figure 7.1 presents the context in which the EMME/2 based transportation modeling system is being used to aid various planning analyses and decision-making activities. This figure represents several components of the process that is used in planning analyses. The relationship among these component parts would be the same irrespective of whether a computerized model or hand calculations are being used in the second box. Figure 1 identifies six basic components:

a) Inputs. This includes data, assumptions and alternatives being analyzed.

b) Analytical Model. This is described in a subsequent section.

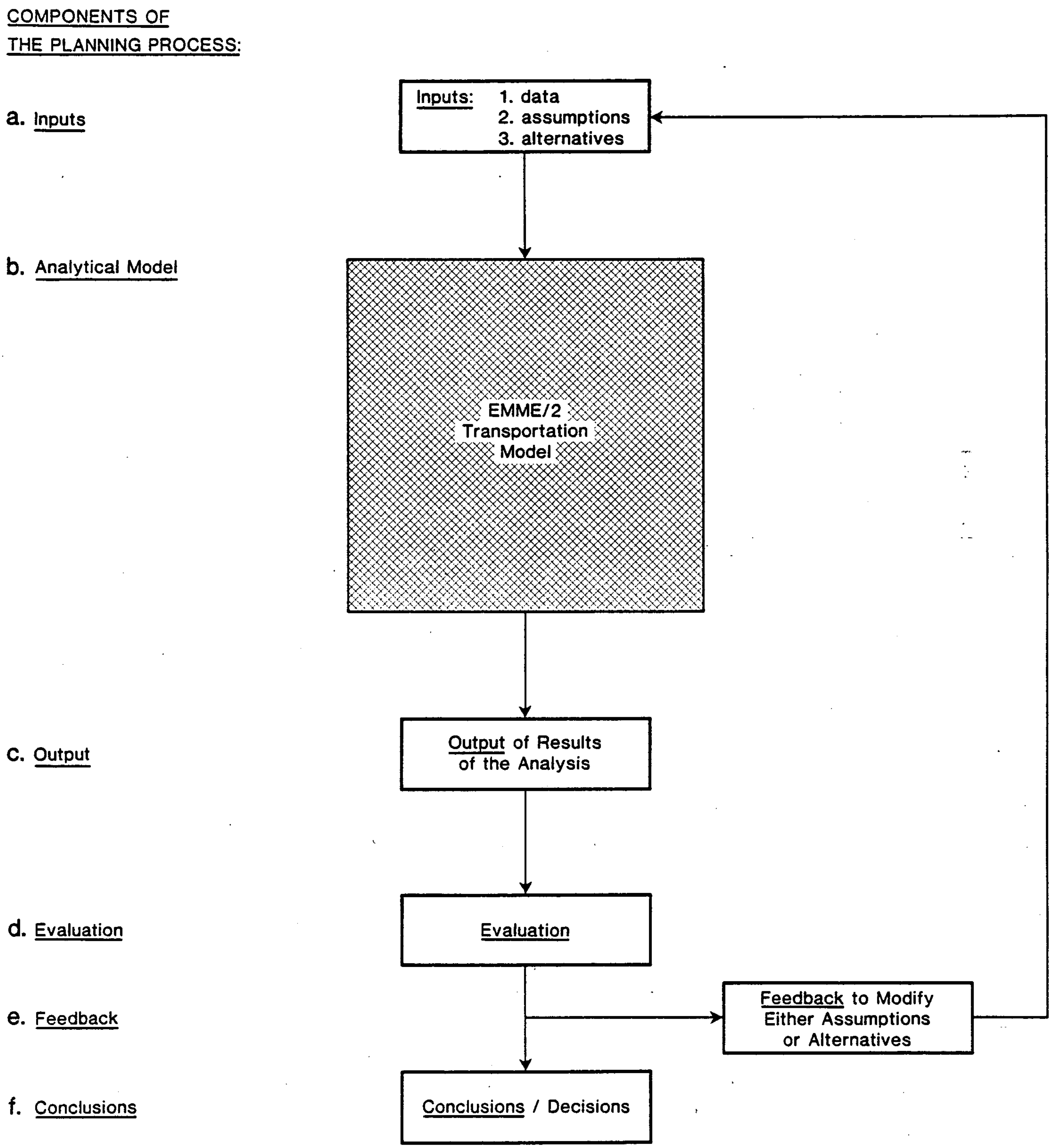
c) Outputs. Various tabular and graphical summaries of the results of the model analysis.

d) Evaluation. Interpretation of the results by comparing them to some previously defined expectation.

e) Feedback. This is used when the expectation of the previous component has not been met and a modification is made either to the assumptions or alternatives and the first four components of the process are repeated.

f) Conclusion/Decisions. At some point in the process, conclusions and decisions need to be reached based upon the results and evaluation of the analysis outputs.

Figure 7.1 Analysis Context in Using Transportation Models



2. <u>The Structure of Transportation Models</u>:

Transportation models are generally structured to analyze the flow of trips of people and/or vehicles over highways and/or transit networks throughout a specified geographic area. The geographic area is usually divided into many small sub-areas, termed transportation zones. The networks are usually identified by (a) points of intersection on the network, termed "nodes" and (b) segments of the networks between the nodes, termed "links." These terms are schematically illustrated in Figure 7.2. This structure of transportation models, of zones and networks, results in there being those two basic sets of data, assumptions, and alternatives as input components of the modeling process. Some specific examples related to the EMME/2 model are given next.

a) <u>Zone Data.</u> The primary model data relating to zones is first the number households and then the amount of employment, the latter of which is divided into four types (office, retail, industrial, and other). This primary zone data is supplemented by other data or assumptions, such as parking cost, access and egress times, or land area.

The TRIMS model used by the M-NCPPC since the 1970's has been based on a 351 transportation zone system describing the Washington Metropolitan Region. This consists of (1) 15 external stations, (2) 246 zones within Montgomery County, and (3) 90 large zones encompassing the remainder of the region. Map 7.1 shows the 246 zones within Montgomery County. The 90 zone regional geographic system is an aggregation of the 1,200-zone system used by COG for the entire region. This zonal data structure has been retained in the M-NCPPC's EMME/2 regional model.

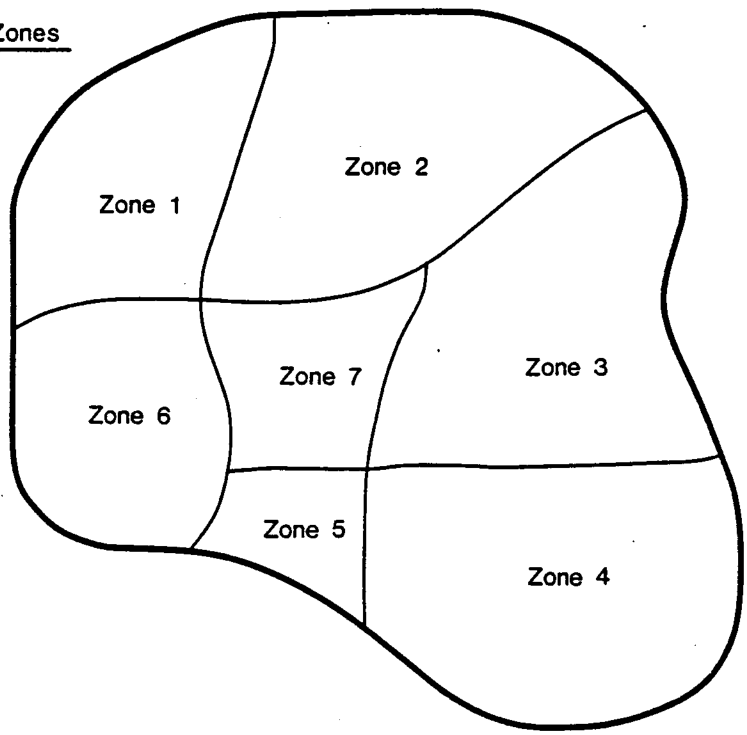
b) <u>Network Data.</u> The highway network of the old TRIMS model system consisted of two-way links coded into a mainframe computer database management system. Each link had numerous attributes coded to it describing, for example, its capacity, speed, length, and location.

This old network was used as the basis for coding a new highway network for use by the new EMME/2 model. The new network database contains more than 8,000 one-way links describing the region's transportation system. Roughly half of these links are within Montgomery County, where the network provides a moderate level of detail including all major and many secondary roads. A page size map produced by the EMME/2 modeling system showing the full network associated with the FY 88 AGP is given in Map 7.2.

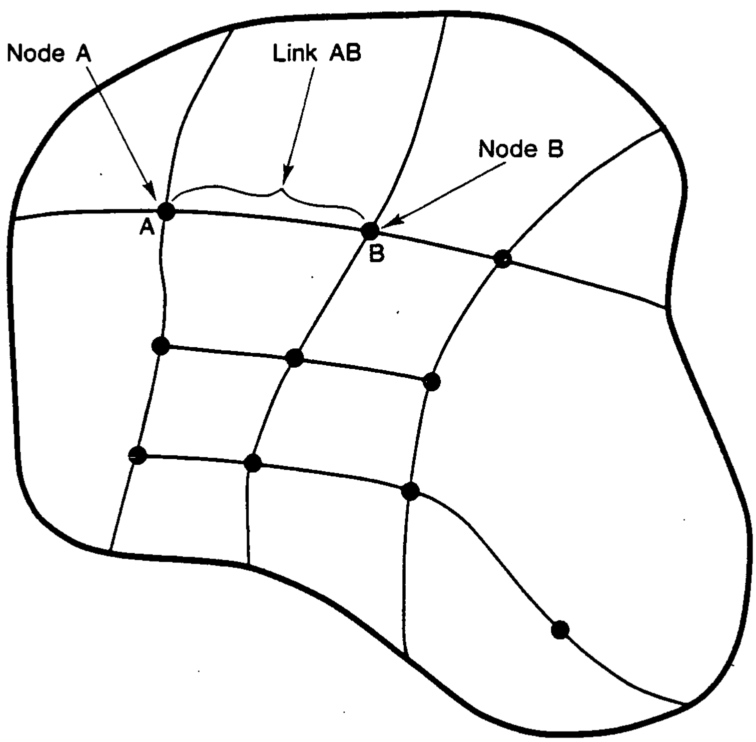
The transit network has been coded "on top of" the highway network links. Transit speeds have, in most cases, been determined as a function of simulated automobile travel times on links and a unit of stop delay per mile of link distance. Rail lines are coded on their own right-of-way. Speed and delay factors are calibrated to observed transit schedules. About 350 to 400 transit lines, including some lines that are a composite of

Figure 7.2 Schematic Structure of Transportation Models

A:Transportation Zones

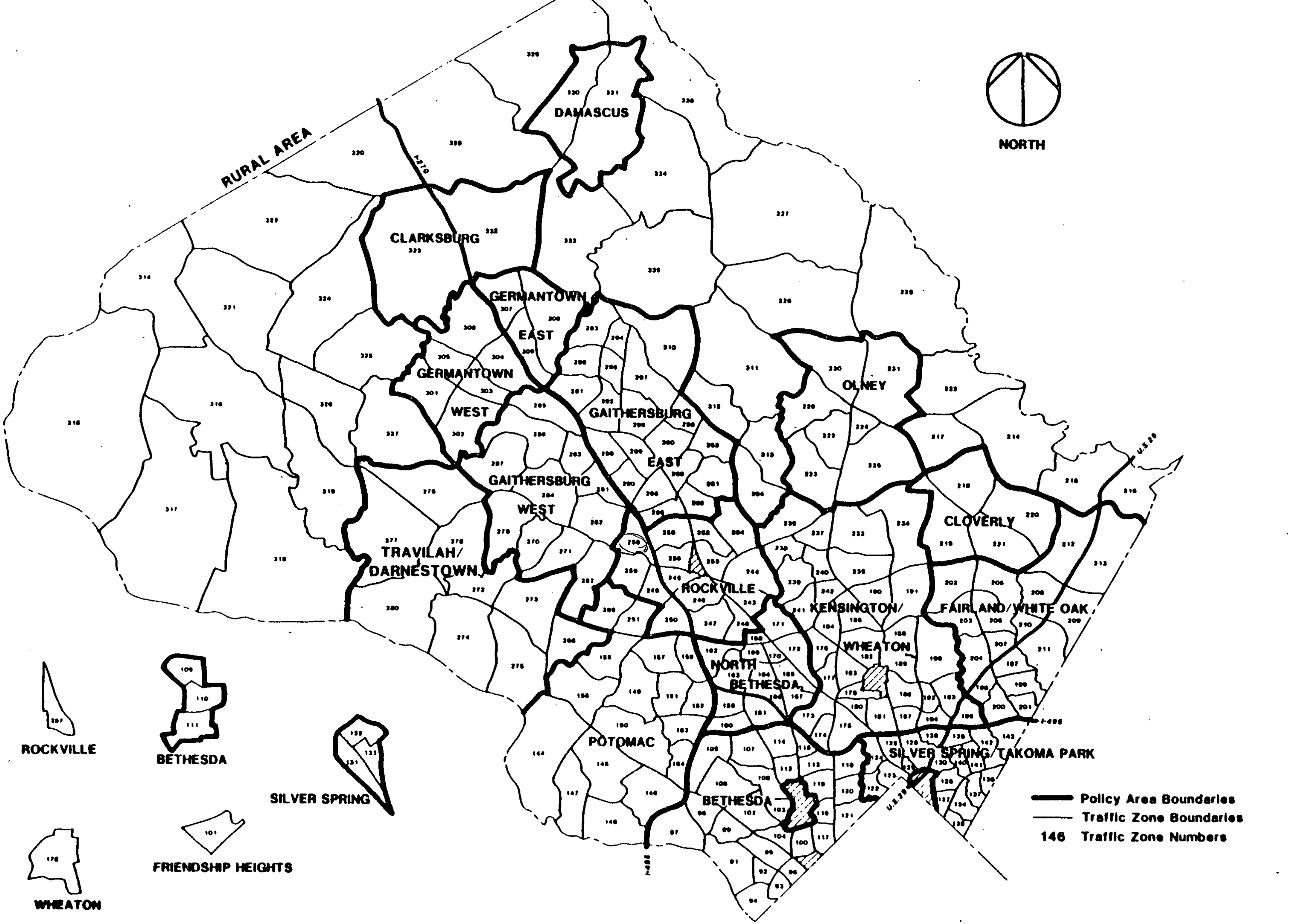


B:Transportation Network



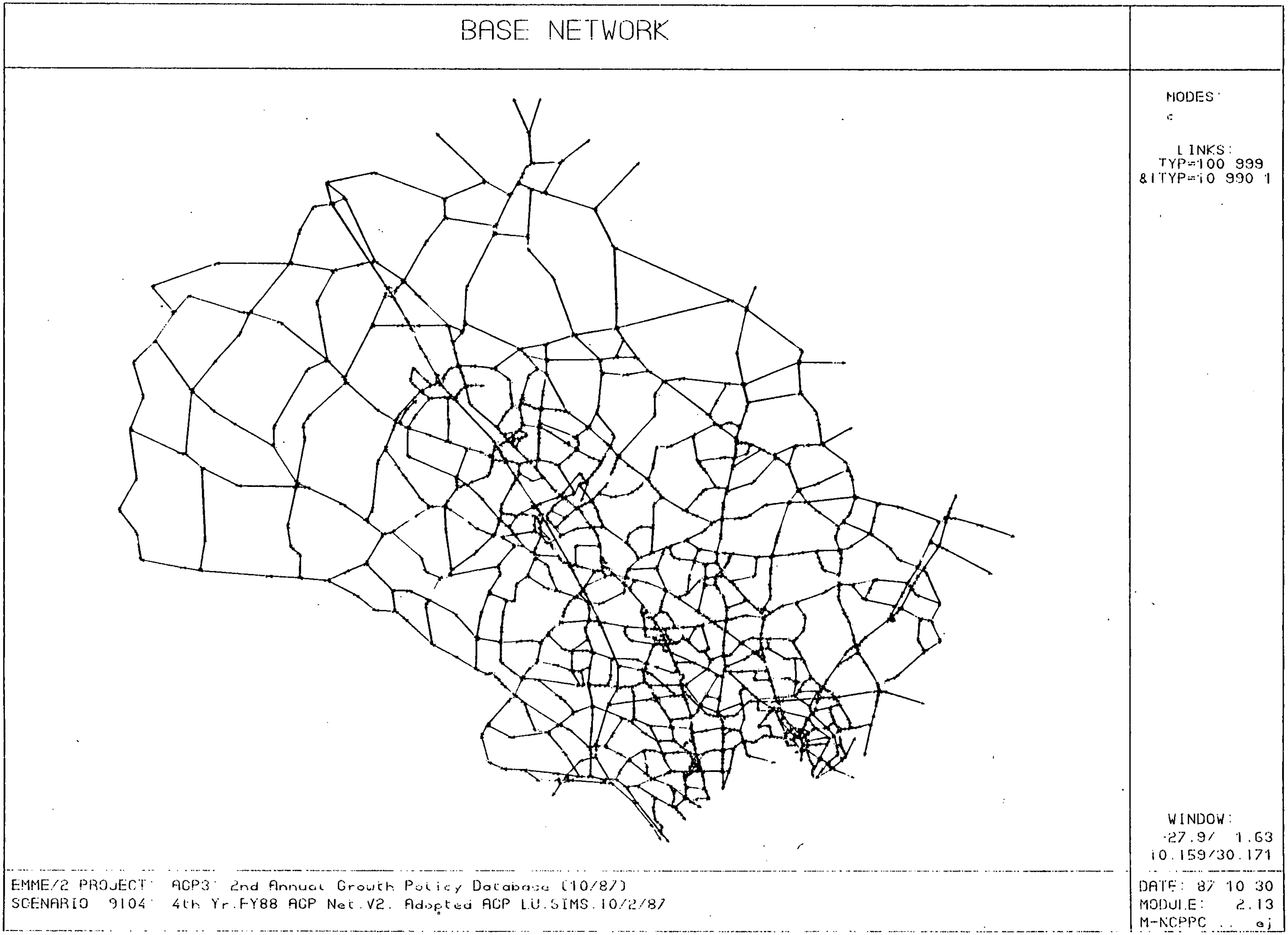
Map 7.1: **POLICY AREAS BY TRAFFIC ZONES**

Montgomery County, Maryland



SOURCE: Montgomery County Planning Department

Map 7.2: Highway Network Used with the FY 88 Annual Growth Policy



several routes, have been coded for different years, including 1980, 1985, 1987, and 1993 networks. Significant efforts are still needed to refine this network coding before a full transit model will be available for analysis. However, the current model system provides sufficient information to support a transit-sensitive AM peak hour highway model.

2. Techniques Used Within the Transportation Model:

Like most conventional regional transportation planning modeling systems, both the new EMME/2 and old TRIMS models use a four-step modeling procedure. These four steps procedures are common to most transportation planning analysis whether they are done by computer or by hand calculations. The analysis techniques followed in these four steps are generally termed: (1) trip generation, (2) trip distribution, (3) modal choice, and (4) trip assignment. These steps are generally carried out in a sequential interrelated manner. However, there are many different techniques that can be used in each of these four steps. As such, a particular transportation model is composed of a specific set or combination of techniques that distinguish it from another model. Irrespective of which particular technique is used in a particular modeling step, each of the four steps is intended to answer one of the following basic questions, respectively:

Trip Generation. How many trips are there beginning and ending in each zone?

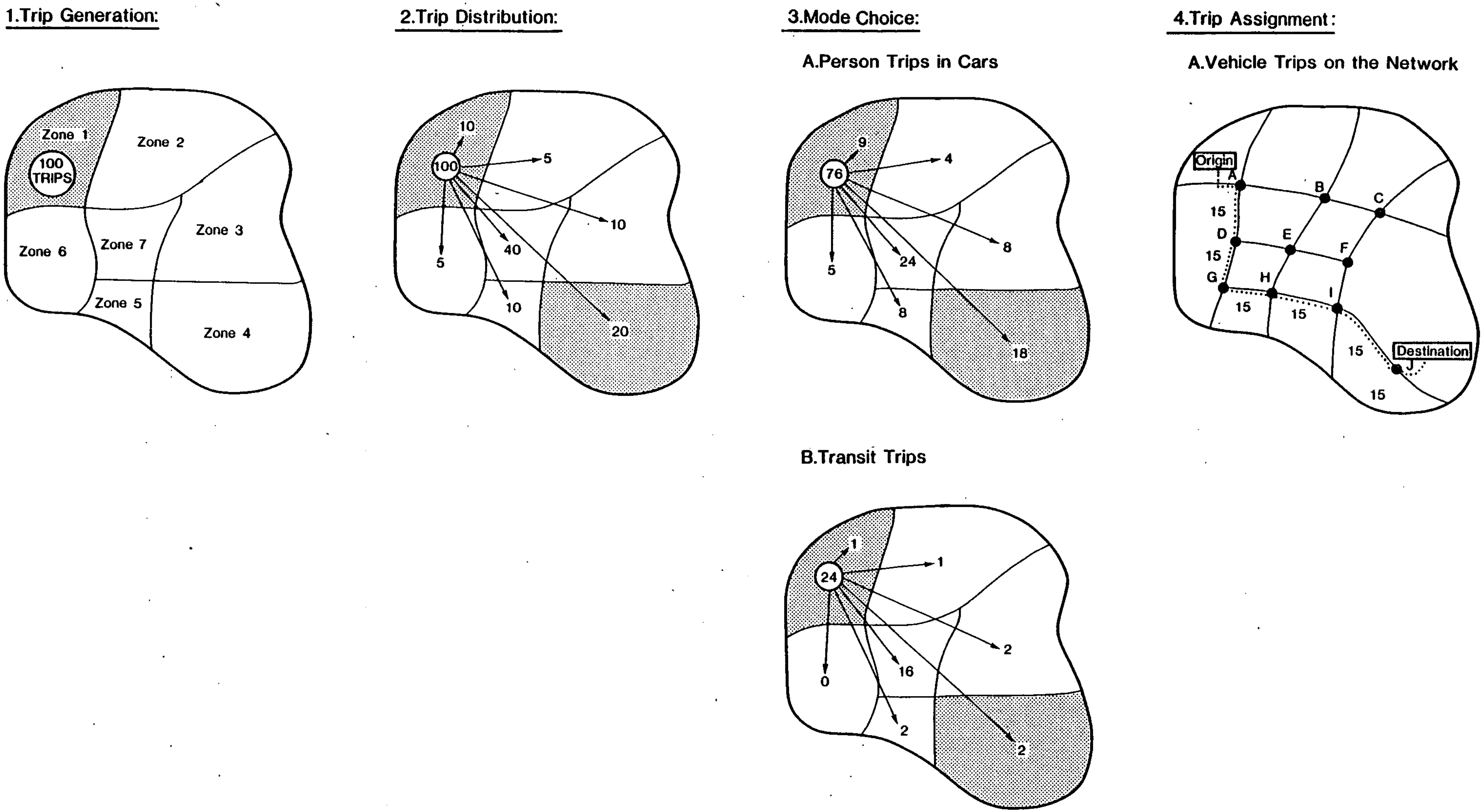
Trip Distribution. What is the pattern, or distribution of trips, beginning in a zone and ending in each of the other zones

Modal Choice. What proportion of the persons going between any zone pair will choose among the available modes of transportation? How many occupants will each vehicle trip have?

Trip Assignment. To what particular path or route on the transportation networks should the trips between any zone pair be specifically assigned?

Figure 7.3 schematically illustrates these four steps for a simple model structure. This illustration shows that: (1) in the first step of trip generations, 100 trips are produced in zone #1, (2) in the second step of trip distributions, that 20% of the 100 trips produced in zone #1 have been distributed to zone #4, for example, (3) in the third step of mode choice, three-twentieths, or 15% of the trips from zone #1 to zone #4 choose to use transit, and with an auto occupancy of 1.2 the remaining 18 person trips would result in 15 vehicle trips, and (4) in the fourth step of trip assignment that the 15 vehicular trips going from zone #1 to zone #4 have been assigned to each link in the path through the network that goes from nodes A to D to G to H to I to J. Doing that process over and over and over... until all

Figure 7.3 Schematic Illustration of a Four Step Transportation Model



Zone 1 generates 100 person trips productions

20% of the trips from Zone 1 are distributed to Zone 4, for example

2/20, or 10%, of the trips from Zone 1 to Zone 4 choose to use transit

15 vehicle trips are assigned to each link along route A–D–G–H–I–J between Zone 1 and Zone 4

zone-to-zone pairs have been accounted for results in an estimate of the traffic volumes on each link in the network.

It was indicated above that a particular transportation model is composed of a specific combination of techniques for each of these four steps that distinguishes it from another model. The EMME/2 modeling system allows for different techniques to be used for each of the steps. The following briefly describes some of the specific techniques that so far have been incorporated into the M-NCPPC's EMME/2 based modeling system.

a) Trip generation takes land use data on households and jobs, by zone, and calculates daily zonal trip productions and attractions for several trip purposes (e.g. Home-Based Work, Home-Based Shop, Home-Based Other, and Non-Home-Based). The total number of trips is dependent upon what trip generation rates are used. Specific rates are identified in a later section.

b) Trip distribution evaluates the relative attractiveness of each destination to all others and distributes the trips on the basis of a "gravity" technique, the same one used in the TRIMS model. Zone-to-zone travel times are used by the gravity technique to convert generated trips into a pattern of trips between all zone pairs. Like Newton's Law of Gravity, from which the technique is derived, the number of trips between an origin A and a destination B is inversely proportional to the travel time between A and B and proportional to the attractiveness of B relative to all other destinations. Socio-economic adjustment factors (K-Factors) are also applied in this step to account for interactions not readily captured by the simple assumption that travel time is the only determinant of people's behavior in establishing their patterns of trip making.

c) Mode choice first evaluates the relative time and cost of traveling between each origin-destination zone pair. Then, using other empirical observed relationships, this technique calculates the percent of trips between each zone pair that will likely be made by automobile or by transit. These factors are used to split the Home-Based Work (HBW) person trip table into a HBW auto driver table and a HBW transit passenger table. The key components used to assess transit use and automobile occupancy are the relative travel time and travel costs from A to B by auto and transit, including parking and fares, for each mode. Subsequent discussion elaborates on the specific techniques being used.

d) Network assignment is accomplished by first combining the trip tables for the various trip purposes into composite daily or peak hour trip tables for highway vehicles and transit passengers and then assigning

these to the highway and transit network, respectively. Different techniques exist for assigning these trips to individual roads or transit services, but these generally seek to minimize delay or travel time in selecting travel paths, including considerations of link capacity and congestion effects. The equilibrium traffic assignment technique is used in the EMME/2 modeling system and is described in a later section.

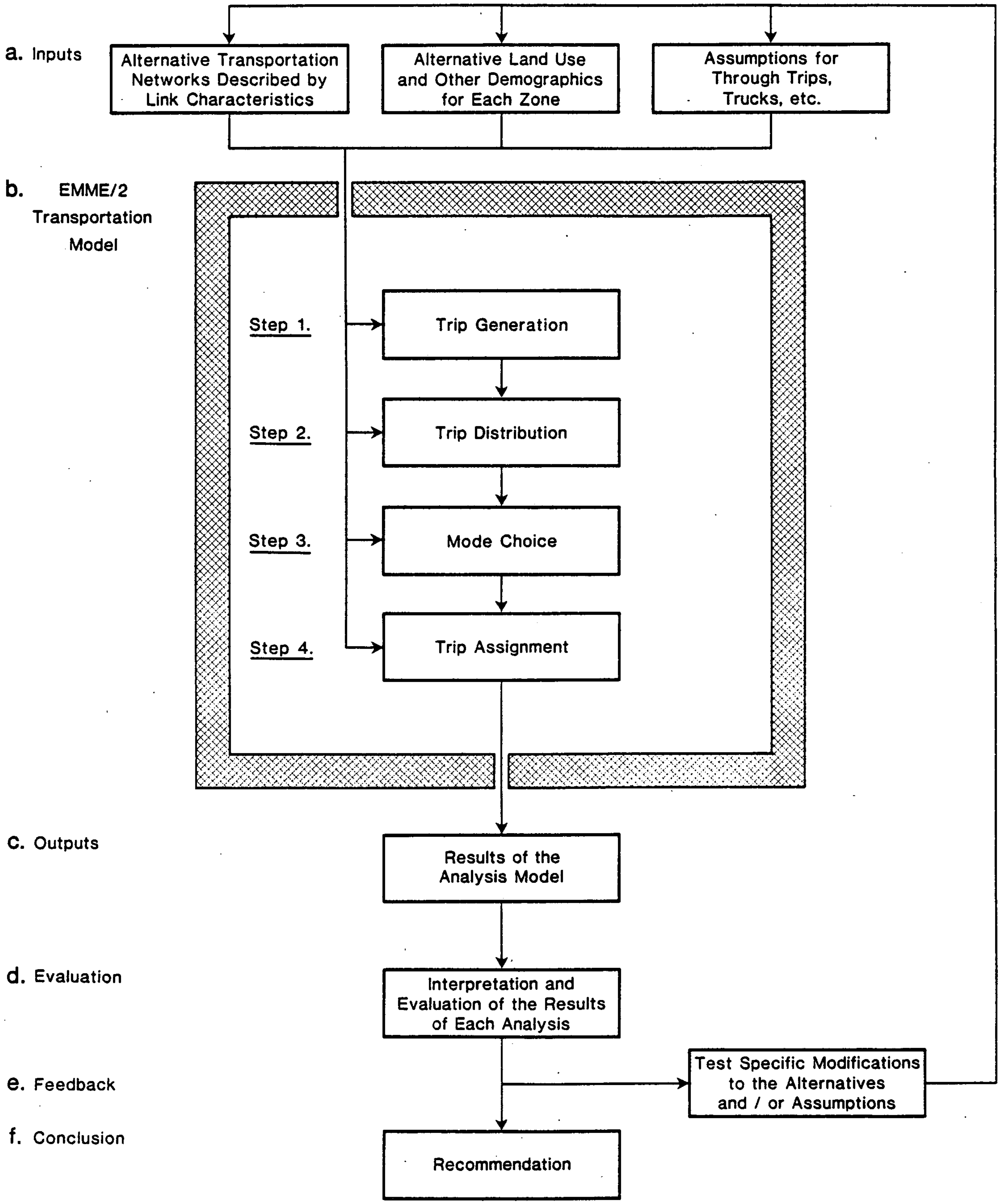
Figure 7.4 shows how these four basic steps within the transportation model relate to the analysis context previously given in Figure 7.1. The inputs involve: (1) network descriptions for each link, (2) land use and various demographic information for each zone, and (3) assumptions or data relating to items such as through traffic or the number of truck trips. As schematically shown in Figure 7.4, these inputs can go to any combination of the different steps within the transportation analysis model depending upon the specific techniques used in constructing the model. This diagram of the general relationship among the analysis processes and model steps may appear to be complex to those not that familiar with analytic models. However, compared to the specific diagrams needed to develop the actual logic of the computer programs to do the modeling this is a gross simplification. Various intermediate schematic diagrams of the modeling steps can be drawn, for technical review, that more clearly show the interrelationship among various specific inputs and steps of the modeling.

4. Further Enhancements to the EMME/2 Transportation Model:

Taking advantage of the flexibility offered by EMME/2, Planning Department staff are in the process of incrementally adapting, enhancing, and recalibrating the existing travel demand modeling techniques that had been part of COG's TRIMS model systems. The initial EMME/2 model system incorporates many of the same model techniques and parameters used in the old TRIMS system. The EMME/2 system can be viewed as being a modular modeling system. As such, when enhanced techniques are available in the future, such as improved trip generation equations, a better auto occupancy technique or developing PM peak hour trip splitting factors, then they can be incorporated into the model system.

The process of continued model development is dependent on both the availability of appropriate calibration data sets and sufficient staff time being set aside from the applications of the model systems. Both have served as constraints on the pace of model development and calibration improvements. Several major new data sources will be available in the next year to permit significant further model development and recalibration for enhanced performance.

Figure 7.4 Relation of the EMME/2 Model to the Analysis Context



D. KEY DIFFERENCES BETWEEN THE OLD AND NEW MODELS

There are several key differences between the old TRIMS model used by the Commission in the FY 88 Annual Growth Policy and the new EMME/2 model system being used for the FY 89 Annual Growth Policy. These are shown in Table 7.1 and the more important ones are discussed below.

1. Trip Generation.

The trip generation technique used by the new model follows a structure similar to that of the old model, with area-specific trip generation rates which are applied to households and employment by type. However, while the old model used the same rates throughout virtually all of Montgomery County, the new model stratifies the County into four areas which have different rates based on observations from the M-NCPPC 1984 Census Update Survey and 1980 Census Journey-To-Work Survey data. In general the more urbanized areas have lower rates than the less urbanized areas. Over the next year, this area-based approach will likely be replaced by a more generalized technique based on household size, automobile ownership, intensity of pedestrian infrastructure, or other factors. Table 7.2 shows the daily trip generation rates currently being used in the new M-NCPPC EMME/2 model system for areas within Montgomery County. Other rates are not shown in this table which are used in other parts of the region beyond Montgomery County. It should also be noted that these rates should not be directly compared to peak hour vehicular trip generation rates used in traffic impact studies for local area review. To get an approximate comparison one needs to add across the rows in Table 7.2, double the number, divide by the percent of travelers in the peak hour for each trip purpose, and account for mode choice and auto occupancy.

A key difference between the trip generation technique of TRIMS and EMME/2 is the development of AM peak hour trips from the initial daily trip generation rates. Indeed, this is perhaps the most significant departure from the old model system. This peak hour technique explicitly handles the previously difficult problem of "spreading" of the peak hour. It also reflects differences in peaking characteristics between different parts of the metropolitan region, which also exhibit change over time. The key elements determining the percentage of daily trips made in the AM peak hour for a given trip interchange are the household density at the origin end and the employment density at the destination end, with lower peak hour factors for higher density locations. This technique is discussed more fully in the section below on peak hour traffic estimation.

2. Trip Distribution.

No changes were made in the coefficients of the gravity model technique previously employed in TRIMS. A slight modification in format was made to convert these complex curves into stepwise linear functions with similar forms. Changes may be made in

TABLE 7.1: GENERAL COMPARISON OF THE M-NCPPC'S TRIMS AND EMME/2 MODEL SYSTEMS

STEPS IN THE THE MODELING PROCESS	SPECIFIC COMPONENTS OF THE MODEL SYSTEMS	
	TRIMS	EMME/2
INPUTS	o batch mode o two-way links o through traffic o unconstrained speeds	o interactive graphic or batch o one-way links, optional intersection coding o peak hour volume/delay functions o unconstrained speeds o network libraries
TRIP GENERATION	o daily trip rates by four trip purposes with common rates throughout Montgomery County o independent variables of four employment types	o daily trip rates by four trip purposes with differentiation between Up County and Down-County rates o independent variable of four employment types o peak hour trip Table splitting factor model based on development density
TRIP DISTRIBUTION	o traditional gravity model	o traditional gravity model o new socio-economic adjustment factors
MODE CHOICE AND AUTO OCCUPANCY	o metro and non-route specific regional sketch model at district level o car occupancy factor	o route specific transit model (SIMS) at detailed zone level o car occupancy factors o new COG/Barton-Aschman model with vehicles by number of passengers
TRIP ASSIGNMENT	o iterative capacity constraint/minimize time o BPR function, LOS C diversion o use peak hour factors to compare daily volumes to hourly capacities	o equilibrium assignments of the peak hour trips compared to peak hour volume-delay functions/minimize total delay o turning count options, intersection delay o transit assignment as well as auto assignment o explicit modeling of truck, bus, and auto access to Metro trips
OUTPUTS	o daily volumes o constrained speeds o printouts or subsequent graphics	o peak hour volumes o intersection delays o constrained speeds o optional turning movements o graphic displays or printouts o scenario packages

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TABLE 7.2: Selected Summary of Trip Generation Rates for Areas Within Montgomery County Being Used by the EMME/2 Model

Area Within Montgomery County	Daily Home Based Trips Produced Per Household by Purpose		
	Person-Trips for Work	Vehicle-Trips for Shopping	Vehicle-Trips for Other Purposes
Silver Spring/ Takoma Park Areas	1.80	1.30	1.20
Bethesda/Chevy Chase Areas	1.80	1.50	2.00
Mid County and Up County Areas in the Corridor	2.40	1.85	2.00
Potomac and the Rural Areas in the Wedge	2.40	2.00	2.10

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the future in the trip distribution technique based on results from the COG Household Travel Survey being conducted in the Spring and Fall of 1987.

Ideally, the trip distribution technique should directly account for variations within the region of socio-economic factors such as income, employment, and housing type, which would affect the pattern of trip making. While Planning Department staff hope to explore such possibilities, the availability of calibration data and the ability to forecast data inputs for such a refined trip distribution technique may limit progress in this area.

Techniques have been applied in this step to account for these interaction effects between areas which are not captured by a simple gravity technique based on travel time interactions. A new set of socio-economic trip distribution adjustment factors (K-factors) was calibrated for the M-NCPPC EMME/2 model. The Home Based Work (HBW) observed vehicle trips from the 1980 Census Journey-To-Work data has been compared with simulated HBW vehicle trips for 1980 to develop these factors. They have been used to improve the trip distribution technique's ability to simulate observed transportation behavior. While these adjustment factors are probably stable in the short term, it is likely that they will change in the long term.

In developing the specific adjustment factors serveral trip making patterns that vary from the model predictions were noted. As one example, the trip distribution technique tends to under-predict the number of HBW trips from most residential areas in Prince George's County to most Montgomery County employment centers. This is most likely due to the need for many Montgomery County workers to travel further than the trip distribution technique predicts to find suitable quality housing at more afforadable prices. As another example, the technique tends to overpredict the number of trips that cross the Potomac River, likely due to people's resistance to crossing state lines and major geographic and psychological barriers. In both these examples, travel time alone is not a sufficient indicator of propensity to make a certain trip over other equally distant choices. There are other situations for which it was necessary to use socio-economic adjustment factors.

3. Mode Choice Techniques.

The TRIMS model system used a sketch-level transit model to estimate the percent of person trips that would choose to use public transportation. In the mid 1970's, this model was coded to describe non-route specific bus services on selected roads which were to represent the bus system. Generalized transit access, egress, and wait times were assumed for each zone. Two transit systems descriptions, one pre-Metro (1975) and one post-Metro (1985/90), were coded into the model data setups at that time. The only route specific transit network element that was coded in this old model was the Metrorail system. This non-updated, sketch-level mode choice technique was used to estimate

transit travel time between origins and destinations. This technique was used in conjunction with a more regularly updated regional sketch-level highway network that gave automobile travel time estimates. Together they provided inputs for a simple mode choice technique TRIMS used to estimate the percentage of HBW transit use for each origin-to-destination pair.

After subtracting transit trips from total HBW person trips, the TRIMS model then used a very simple auto occupancy technique to calculate auto driver trips. These auto driver trips for home based work trips are added to the vehicle trips being made for other purposes prior to final traffic assignment. The sole inputs to this auto occupancy technique were the relative income level (low, moderate, high) of the origin zone and the average inflation-adjusted parking cost at the destination.

The new M-NCPPC EMME/2 model has been set up to accommodate several different approaches to mode choice estimations: (a) a technique that use default values for mode shares, (b) the SIMS mode choice technique, and (c) the new Metropolitan Washington COG/Barton-Aschman mode choice technique. They are described below.

a) <u>Default Mode Shares</u>. The initial mode choice technique being used in the EMME/2 modeling system is being termed default mode shares. They were used to directly produce a daily HBW auto driver trip table from the simulated HBW person trip table by making specific assumptions, or default values, on the auto driver as a percent of the total person trips. These assumed default valves for auto driver mode shares for different years were derived from the 1980 Census, a new COG simulation of 1985 mode shares, and an old COG simulation of the Metrorail build-out, representative perhaps of conditions in the late 1990s.

b) <u>Simplified Mode Choice Technique (SIMS)</u>. With the coding of explicit transit networks for 1980, 1985, 1987, and 1993 within the EMME/2 model, it became possible to directly calculate transit travel times from the network model for these years. With this information, the SIMS (Simplified Mode Share) technique, developed by COG several years ago for applications in Fairfax and Montgomery County, could be applied in the EMME/2 framework. Network coding differences made it imperative to recalibrate this model to better match observed Census data. After testing several variations, an acceptable calibration was achieved that enables the M-NCPPC's EMME/2 model system to perform transit sensitive AM peak hour highway simulations. However, this model still needs further refinement before it will support direct estimates of projected public transportation use.

SIMS mode share factors are used to calculate HBW transit trips for subtraction from the HBW person trip table, yielding HBW automobile person trips. In the current M-NCPPC EMME/2 installation, the same auto occupancy technique used in TRIMS is employed to convert these HBW automobile person trips to HBW vehicle trips.

c) <u>COG/Barton-Aschman Mode Choice Technique</u>. In the near future, the Planning Department staff expects to incorporate into the EMME/2 model framework the Metropolitan Washington COG/Barton Aschman mode choice techniques. It directly calculates from a HBW person trip table estimates of HBW transit trips and HBW auto trips by automobile occupancy group (1 person, 2 person, and 3 or more person trips). This technique will enable the analyses to bemore sensitive to forms of transit service such as High Occupancy Vehicle (HOV) preferential treatment, such as reserved HOV lanes and special HOV parking.

Model runs for the FY 89 Annual Growth Policy analysis have been done using the SIMS mode share model and the TRIMS auto occupancy model, using a transit network representing services programmed for the early 1990's.

4. <u>Peak Hour Traffic Modeling.</u>

While the TRIMS model system focused on daily traffic forecasting, the new M-NCPPC EMME/2 model has been calibrated to directly produce an AM peak hour traffic assignment.

The objective of both traffic models has been to estimate peak hour congestion and the adequacy of traffic conditions given certain assumed land use and network characteristics. To accomplish this with the TRIMS daily traffic forecast, hourly capacities were converted to daily capacities. That was done assuming a fixed factor for the inefficiency of capacity utilization, recognizing that traffic flows demonstrate major peak demands usually twice a day, with very low flows late at night. This can be thought of as being quite similar to converting these daily traffic volumes to peak hour volumes. Only through such a conversion was it possible to estimate a relative composite peak hour congestion level.

There has been relatively little data on which to determine these hourly to daily capacity conversion factors. The factors which had been used in the TRIMS model were a simple cross-classification by route type (expressways, arterials, collectors) and distance from the metropolitan core. A key deficiency of this link-specific factor approach used in TRIMS is its insensitivity to changes over time in the peaking characteristics of traffic.

Common sense suggests and data corroborates that two key factors that influence the peaking characteristics of traffic

are: 1) the land use density and mix and associated demographic character of an area, and 2) the amount of peak hour congestion in the transportation system.

Small towns, sprawling bedroom communities, and isolated industrial or office parks typically display higher peak hour factors -- that is to say that a greater portion of the total daily trips are made in the AM and PM peak hours of traffic -- than do heterogeneous, high-density, cosmopolitan urban centers. Homogenous land use areas, whether office centers or residential communities, where the "sidewalks roll up at 6 o'clock," as the saying goes, attract or generate far more of their daily trips in the peak hours than do places that attract human activity both day and night, regardless of the levels of traffic congestion.

Travel corridors and areas with severe peak hour traffic congestion also experience fairly flat distributions of daily travel demand and low peak hour factors since the peak periods become very long. The famous freeways of Los Angeles where "rush hour" starts at 6 AM and ends at 8 PM, with a slight dip around 10-11 and again around 2-3 come to mind. In response to increased peak hour congestion, people with some flexibility start to alter their travel times to avoid more congested traffic conditions. Obviously, there are social, political, and ultimately theoretical limits to the degree of trip time flexibility and congestion-induced spreading of traffic from the peak hour.

Conventional approaches that use fixed factors to account for peaking characteristics of traffic obviously cannot hope to deal with either of these two conditions that lead to a lowering of peak hour factors over time. The limits of fixed factors became apparent to Planning Department staff trying to evaluate peak hour congestion trends using average daily traffic count data. With the fixed factors, congestion levels of several times the assumed daily capacity were found on more than a few links in rapidly urbanizing formerly rural areas of Montgomery County. Upon closer analysis, it became clear that the link peak hour capacity factors needed to be altered to reflect urbanization and corridor congestion. However, with thousands of links in the model, a systematic and automated approach to establish new factors would be needed. An examination of the available traffic count database yielded more evidence that change was needed but gaps and inaccuracies in the data provided no easy means for reliable calibration of a new link-based model. Indeed, COG had recently undertaken its own assessment of new link-based peak factors for another jurisdiction, with results that looked not too promising.

With the installation of the new M-NCPPC EMME/2 model system, an opportunity for developing a new approach appeared. The alternate and more direct way to get at the question of peaking of demand was to take daily trip tables and to split them to a peak hour trip table for assignment. A computerized database of AM and PM traffic counts going back 15 years for Montgomery County had just been assembled by Planning Department staff as a

new research tool. It seemed promising that a peak hour technique could be developed combining these traffic count data with a) 1980 Census trip table data for work trips, which make up more than three-fourths of AM peak hour trips, and b) data on the percent of automobile trips by purpose by hour of day from a 1980 COG Auto Use Survey of over 600 households.

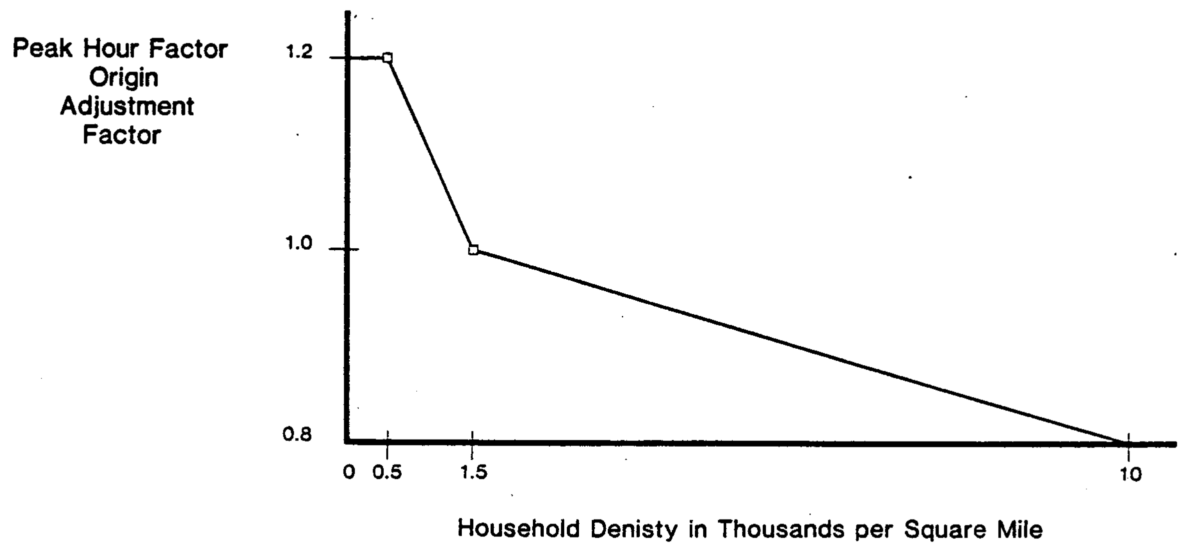
Rough initial factors for splitting daily trip tables were estimated from the COG survey data: 19% of Home-Based Work (HBW) Trips, 3% of Home-Based Other Trips, 1% of Home-Based Shop Trips, and 3% of Non-Home Based Trips were to be assigned to the AM peak hour highway network. The input trip tables were the observed HBW table from the 1980 census and simulated non-work tables based on the COG models. The results were disappointing at first, with substantial oversimulation of vehicle-miles of travel (VMT) in the core areas of the region and substantial undersimulation of VMT in the fringe suburban and rural areas. Then the experimentation began, first with area-based factors, then with density based factors that adjusted these initial trip table splitting factors (TTSF) upward and downward.

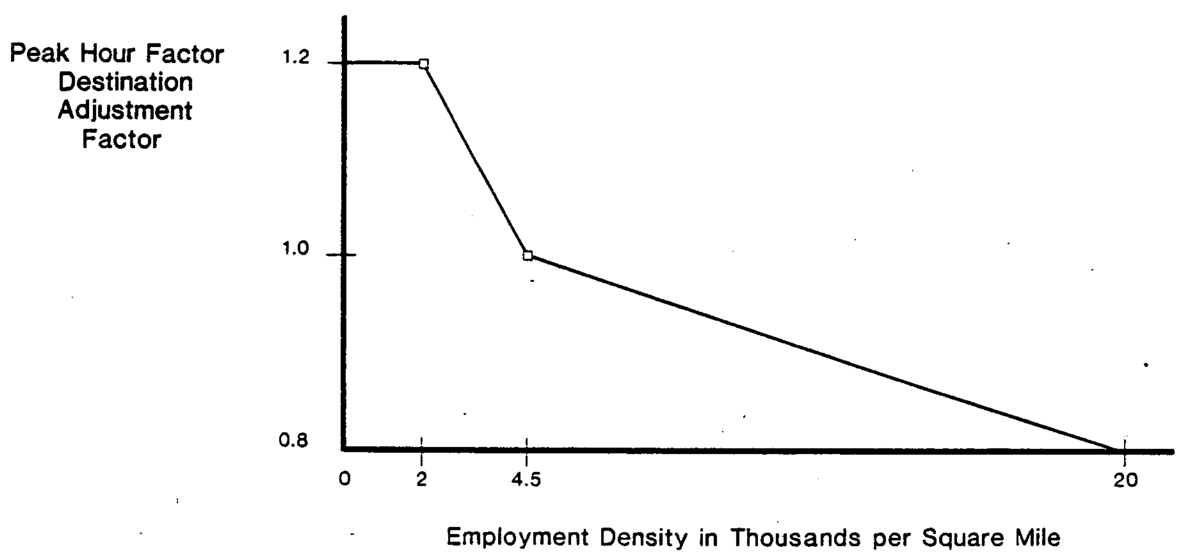
After many tests of alternate forms for this technique, one that produced very close agreement between simulated and observed VMT for both 1980 and 1984 was found. It adjusted the initial regional TTSFs from the COG Auto Use Survey upward or downward by up to 20% at the origin and destination trip ends based on household density at the origin end and employment density at the destination end. As expected, the lowest TTSFs were applicable to high density mixed land use areas and the highest to low density homogeneous areas. The final technique is shown in Figure 7.5.

The performance of the trip splitting technique is such that given moderate household and employment density at both origin and destination trip ends, 19% of the simulated daily HBW vehicle trips between this origin-destination interchange will be made in the AM peak hour. In a case where there is low household density at the origin end and high employment density at the destination trip end, as many as 27% of the simulated daily HBW vehicle trips will be made in the AM peak hour. At the other end of the spectrum, where there is very high household density at the origin and very high employment density at the destination, as few as 12% of the daily HBW vehicle trips will be made in the AM peak hour.

In practice, this technique yields typical 1987 origin zone average factors of about 13-14% for the Bethesda and Silver Spring CBDs, 16-17% for the Kensington-Wheaton area, 20-21% for Gaithersburg, and 22-23% for Poolesville, Damascus, and Patuxent. There is a drop in these factors over time in those zones with increased household or employment density. Using the Round 3.5 Cooperative Land Use Forecasts, the largest relative drops -- up to one-fourth between 1987 and 2010 -- are seen in some Germantown traffic zones, where very large employment and household growth is projected. In such cases the factor is falling from about 22% to

Figure 7.5 Peak Hour Trip Table Splitting Techniques Using Density-Based Adjustment Factors





about 16-17%, which seems plausible given the degree of planned urbanization. By 2010, factors in the Montgomery County inner ring CBDs fall only slightly to 12-13%.

Adjustments were made to the structure of this trip split technique to compensate for the relatively large zone size coded in some parts of the Washington region outside of Montgomery County which affects the computed densities. Another refinement was later made to discount HBW trips in the AM peak hour related to retail employment in those zones with very large amounts of retail employment -- in particular the regional shopping malls, where stores typically open at 10 AM.

This peak hour trip table splitting technique developed by the Planning Department staff provides a means of formally accounting for changes in peak hour factors in response to urbanization over time. Further research with additional data sources is needed to identify the extent to which this empirical model reflects peak spreading due to demographic changes vs. the traffic congestion that typically comes with urbanization. Because traffic conditions in 1980 in the Washington, DC area were not nearly as congested as in many other large metropolitan areas, it is presumed that the majority of the peak spreading simulated by the model is due to urbanization itself. A fruitful project for U.S. Department of Transportation or academic research would be a test of for sensitivity of peak spreading against various corridor congestion levels and land use density conditions in different cities.

5. Traffic Assignment Model.

The TRIMS model system uses a traffic assignment technique common to many computer transportation models of the 1970's termed Iterative Capacity Constrained. This technique assigns trips to the highway network on an all-or-nothing basis to the least-time travel paths for a set portion of each origin-destination pair. It then recalculates the trip times between all origin-destination pairs, taking into account that some links become more congested and hence their speed drops. With these new travel times, it then assigns another portion of the origin-destination pairs to the network, repeating the same method a dozen times or more until the full number of trips in all origin-destination pairs have been assigned to the network. This technique gives acceptable results but can result in fairly "lumpy" loadings on the network. The results can also vary significantly depending on the sequence in which zone pairs are assigned to the network.

The EMME/2 model software provides a state-of-the-art equilibrium traffic assignment technique. It assigns all highway travel demand simultaneously to the network seeking to minimize total delay within the network by using linear programming techniques. After 10 to 25 assignment iterations, the assignment comes to an equilibrium closure, with ever smaller variations in the optimal solutions found through each successive iteration.

In general, the more congested the network, the more iterations needed to get to the point of equilibrium.

The initial free-flow travel time on each link in the network is described by its "volume-delay function classification," which also specifies how the travel time changes as the volume on the link increases relative to its coded capacity. Thus, the assignment procedure accounts explicitly for congestion delay. Results of the Inventory of Delay conducted in June, 1987 will be reviewed in the coming year to further refine these volume-delay functions. The specific values selected for these functions also have a direct bearing on the resulting calculations of the average Level of Service for each Policy Area derived from the EMME/2 model.

Equilibrium assignment is generally regarded as providing superior results to those achieved with the iterative capacity constraint method. EMME/2 uses the same technique in assigning transit trips.

6. Other Differences.

Other key differences between the old and new models are that the new model, unlike the old, explicitly includes truck trips, buses, and automobile access trips to Metro stations.

The TRIMS model had been calibrated to simulate total daily traffic volumes, which include trucks, without accounting for the extra impacts that trucks and buses have on the use of road capacity. The new M-NCPPC EMME/2 model uses estimates of regional light, medium, and heavy truck trips obtained from COG truck trip models. These have been added up into one composite truck trip table. COG truck trip tables have been obtained for 1980, 1995, and 2010, and M-NCPPC staff have interpolated these tables to intermediate years as appropriate. The 1995 truck trip table has been used in model runs for the FY 89 Annual Growth Policy.

The best available data on truck trips in the Washington metropolitan region is from the 1968 COG travel survey and even that is weak for time-of-day travel information. On the basis of studies in several U.S. cities, staff has assumed that 8% of all light, medium, and heavy daily truck trips occur in the AM peak hour. Staff has also assumed that each truck vehicle trip is the equivalent of two automobile trips in terms of the use of road capacity. Thus, 16% of the total daily composite COG truck trip table for appropriate years is being loaded onto the M-NCPPC AM peak hour highway network to simulate the impacts of truck traffic on the region's roads. The collection of current basic data on truck trip characteristics in Montgomery County and the region should be given priority to verify the correctness of these assumptions.

The old TRIMS model also ignored the congestion effects of bus traffic on roads. The new model system explicitly assumes that each

scheduled AM peak hour bus trip is the equivalent of two automobile trips on the roads where it runs.

Automobile access trips to Metrorail stations were simply ignored in the old TRIMS model system. However, these constitute a significant unestimated source of local congestion around stations with major park-and-ride lots or garages, such as Shady Grove, Silver Spring, and Grosvenor. The new model system includes 60% of the observed 1985 AM peak period automobile driver trips to Metro stations as additional traffic demand on the network for all 1985 and later traffic assignments. This trip table was obtained from the Metro Station Access Survey and tabulated by COG for the M-NCPPC. Staff hopes in the next year to develop a refined submodel for auto trips related to transit access that will reflect parking capacity and expected utilization at both rail and bus park-and-ride lots.

E. CALIBRATION OF THE NEW EMME/2 MODEL SYSTEM

The technique of calibrating computer transportation models is part art and part science. However, the results of a model calibration effort can be subjected to numerous statistical and quantitative measures. The key to any model calibration is the availability of observed data describing different aspects of the system being modeled. The greater the complexity of the system, the more desirable it is to have multiple observed data sets describing the system from different perspectives and at different points in time.

The new M-NCPPC EMME/2 transportation model has been calibrated on several key data sets which serve as its foundation. The two most important data sets are: (1) the 1980 Census Journey-To-Work trip tables, which describe how many people typically commute from each traffic zone to each other traffic zone by mode of travel, and (2) a newly coded M-NCPPC database of AM and PM peak hour intersection turning movement traffic counts collected over the past 15 years by the Montgomery County Department of Transportation. By a number of measures against these two data sets the model appears to be well calibrated.

Table 7.3 shows the differences between the model simulations and the observed Census Home Based Work (HBW) auto driver trips for 1980. As can be seen, this yields a close match. Figures 7.6 and 7.7 and Table 7.4 show the simulated and observed Census HBW public transportation mode shares (percent transit use) and average auto occupancies (persons per auto) for 1980 for the initial transit calibration. Separate figures are shown for trip origins and for trip destinations. The information is summarized by policy area, as shown by the initials on the bottom of the figures. The policy areas are ordered from left to right to give an appropriate "cross-section" of the County, first on the western side and then on the eastern side. While these too give a relatively good additional match, work will be done in FY 88 to further improve the transit calibration.

TABLE 7.3: Ratio of Simulated to Observed Home Based Work Person Trips

(1980 Simulation Using the EMME/2 Model Versus the 1980 Census)

Geographic Area	Ratio of Simulated to Observed HBW Person Trips	
	Origins From	Destinations To
1. District of Columbia: (Total)	0.95	0.94
a) Core	0.92	0.97
b) Non-Core-North	1.01	0.78
c) Non-Core-South	0.90	0.93
2. Northern Virginia: (Total)	1.08	1.15
a) Arlington/Alexandria	0.98	1.08
b) Remainder Inside Beltway	0.95	1.17
c) North Outside Beltway	1.13	1.10
d) South Outside Beltway	1.16	1.24
3. Prince Georges County: (Total)	0.98	0.97
a) Inside Beltway	0.93	0.95
b) North Outside Beltway	1.02	1.04
c) South Outside Beltway	1.01	0.97
4. Montgomery County: (Total)	0.98	0.98
a) Bethesda	1.07	0.93
b) Fairland/While Oak	1.02	1.00
c) Gaithersburg/Germantown	1.02	0.97
d) Kensington/Wheaton	0.86	1.07
e) North Bethesda/Rockville	1.03	0.98
f) Olney	0.99	1.00
g) Potomac/Darnestown	1.06	0.99
h) Silver Spring/Takoma Park	0.98	0.98
5. Regional Total:	1.01	1.01

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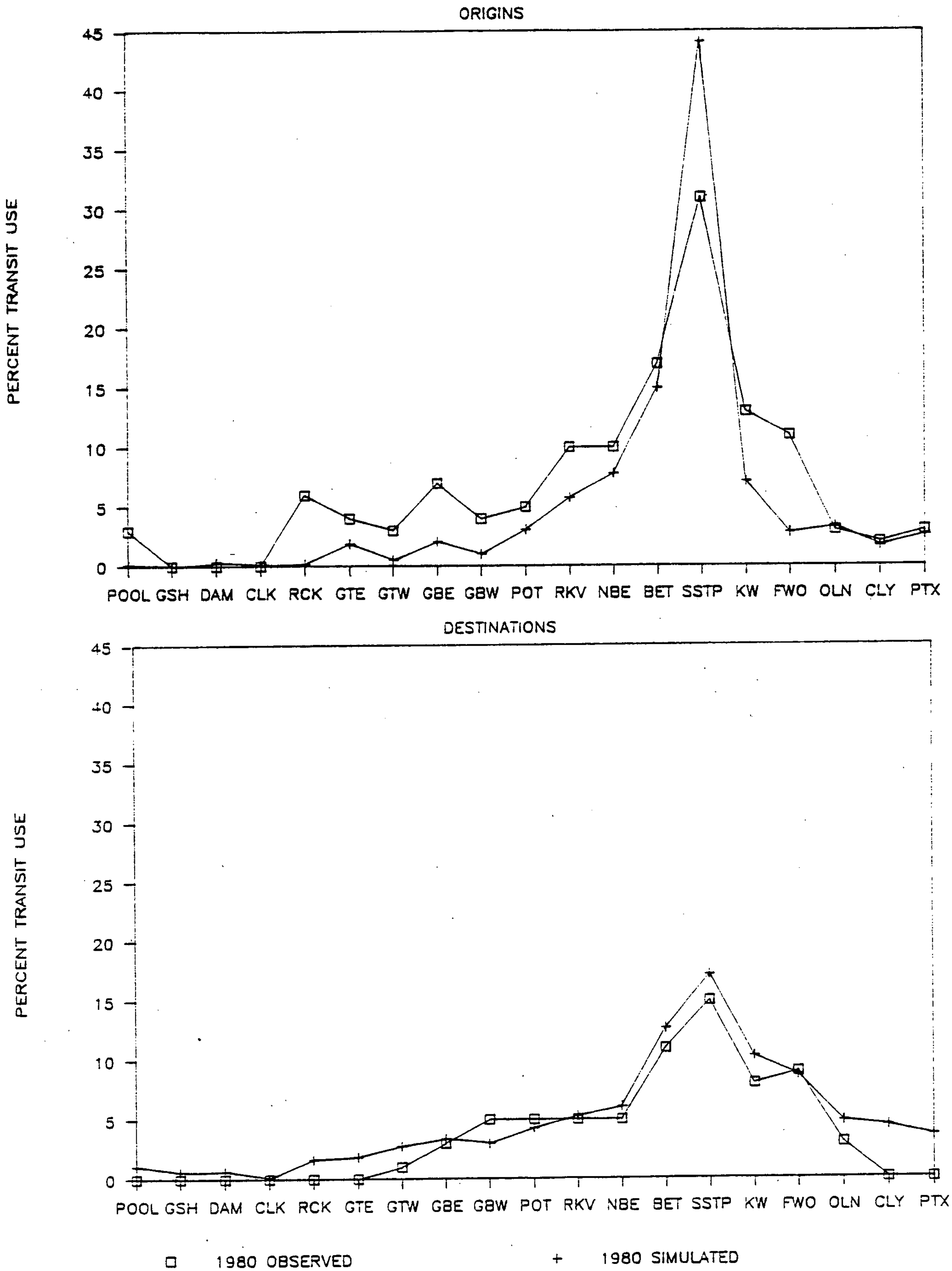

Figure 7.6: Comparison of Simulated and Observed 1980 Transit Use Percentages by Policy Area for Trip Origins and Destinations

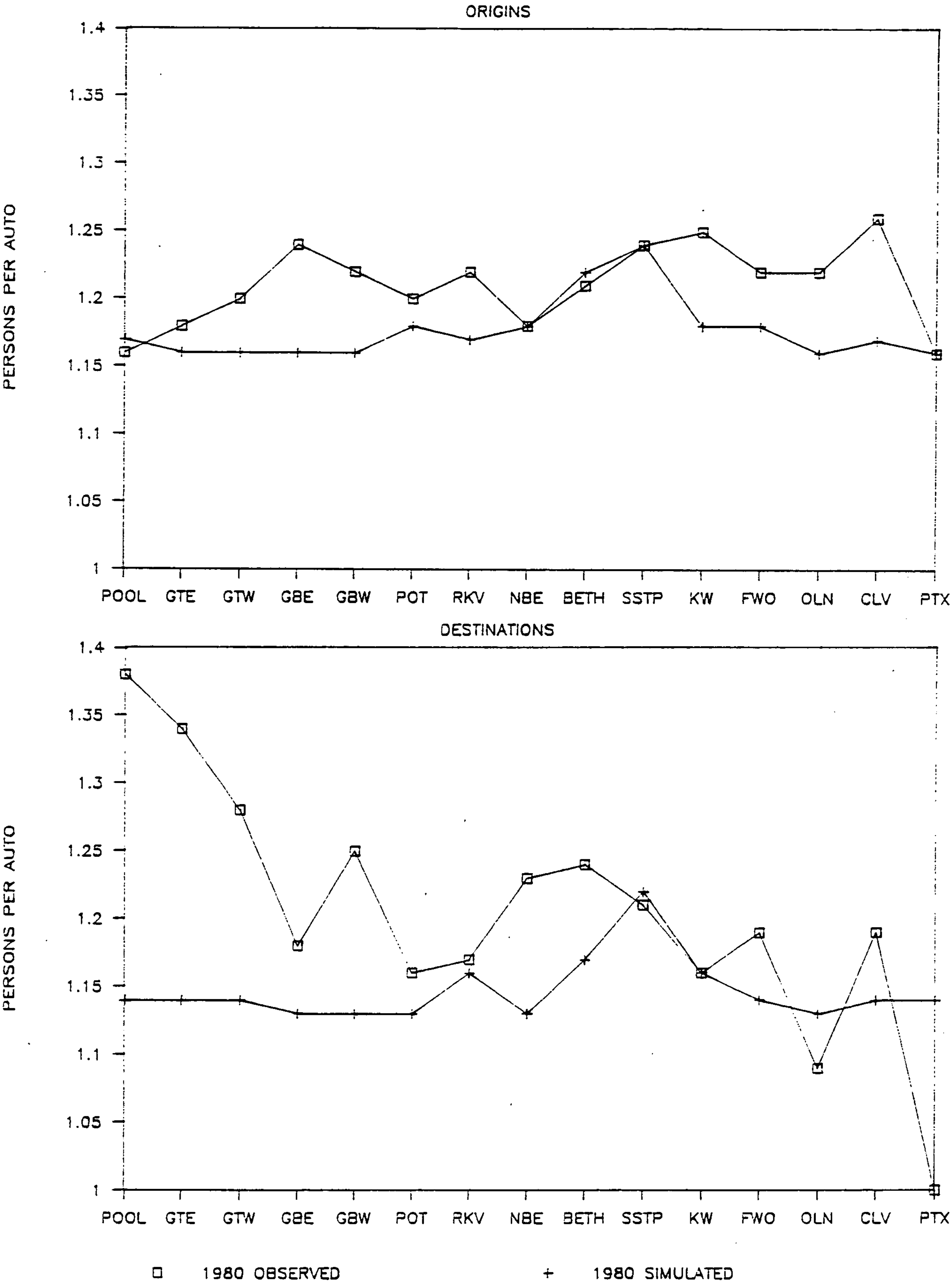

Figure 7.7: Comparison of Simulated and Observed 1980 Auto Occupancy Ratios by Policy Area for Trip Origins and Destinations

TABLE 7.4: Percent Transit Use for Home Based Work Trips 1980

ORIGINS (1980 SIMS SIMULATION / 1980 CENSUS)	DESTINATIONS: District of Columbia	DESTINATIONS: Montgomery County	DESTINATIONS: Prince George's County	DESTINATIONS: Northern Virginia	AVERAGE FOR ALL ORIGINS
District of Columbia	53 / 53	38 / 31	24 / 20	51 / 35	49 / 48
Montgomery County	22 / 30	7 / 6	6 / 4	5 / 6	11 / 13
Prince George's County	20 / 24	8 / 7	13 / 4	40 / 11	14 / 14
Northern Virginia	23 / 30	3 / 4	9 / 3	29 / 6	15 / 13
Average for All Destinations	32 / 36	9 / 8	11 / 5	14 / 8	20 / 20

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TABLE 7.5: RATIO COMPARISON OF SIMULATED TO OBSERVED TRAFFIC VOLUMES FOR 1980 BY POLICY AREA

(values greater than 1.0 represent model over simulation)

POLICY AREAS	Vehicles-Miles-of-Travel	Volume-to-Capacity Ratio
BETHESDA	0.97	1.00
CLARKSBURG	1.05	0.89
CLOVERLY	1.34	1.25
DAMASCUS	1.12	0.82
FAIRLAND/WHITE OAK	1.01	1.00
GAITHERSBURG EAST	0.89	0.98
GAITHERSBURG WEST	0.98	0.98
GERMANTOWN EAST	0.90	0.70
GERMANTOWN WEST	1.04	1.04
KENSINGTON/WHEATON	0.99	0.98
NORTH BETHESDA	0.96	0.98
OLNEY	1.14	0.83
POOLESVILLE/UNSEWERED	1.26	1.60
POTOMAC	0.91	0.95
ROCK CREEK	1.23	1.21
ROCKVILLE	1.00	1.01
PATUXENT	1.26	1.21
SILVER SPRING/TAKOMA PARK	0.98	1.01
Average for Montgomery County	1.00	1.00

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Another test is measured in terms of the simulated AM peak hour traffic volumes against observed AM peak hour directional traffic volumes. As Table 7.5 shows, there is a good match between the modeled and the observed Vehicle Miles of Travel (VMT) and Average VMT-weighted Volume-to-Capacity (V/C) ratios. Indeed, the new model produces better estimates against these more exacting directional AM peak hour traffic counts than the old TRIMS model did for the less exacting bi-directional daily traffic count data. As can be seen in Table 7.5, the policy areas which have the closest comparison are generally the area in the down and mid-County area. The larger number of roadway segments and the larger volumes of traffic in those areas make for an easier comparison. On the other hand, the up-County areas do not generally simulate as well, in part due to the sparse amount of data to describe observed conditions in those areas.

Table 7.6 shows a similar comparison to that of the previous table but this time it is shown for a few of the route types in the transportation network. This table shows that the major arterials tend to undersimulate observed counts, while the other route types tend to oversimulate somewhat.

Another useful statistical measure for calibration is the Root Mean Square Error (RMSE), which indicates goodness of fit between two pairwise matched data sets. Again the new model outperforms the old model by a small amount overall, as shown in Table 7.7, even when disregarding the greater difficulty in simulating directional peak hour rather than bi-directional daily traffic. In general, 35 to 50% RMSE is considered acceptable for traffic models by transportation planners. The new M-NCPPC EMME/2 model has so far been calibrated to 28% RMSE against observed directional AM peak hour traffic counts for 1980, excluding observed counts of less than 300 vehicles per hour. While Table 7.7 shows that the overall difference is small, it also shows that the calibration for the EMME/2 model is more uniform when viewed area-by-area. The TRIMS calibration had several areas, primarily up-County areas with less development and traffic, which varied significantly from the average.

Table 7.7 presented a statistical comparison of how the previous TRIMS model and the new EMME/2 model performed in predicting estimates of traffic volumes observed in 1977 and 1980, respectively. Another comparison that has been made is to see how the model systems performed relative to each other in predicting traffic and congestion levels for the same land use and networks. The general results of such a comparison are given in Map 7.3 and Figure 7.8. Each of the policy areas are classified in Map 7.3 according to whether it is an area in which the previous TRIMS model predicts traffic lower than the new EMME/2 model; or it is an area which predicts traffic higher. The pattern shown in Map 7.3 tends to confirm an expected bias of the previous TRIMS model. The Citizens Technical Advisory Committee that examined the APFO guidelines and TRIMS model in 1982-83 made certain observations that indicate some biases of the TRIMS model. Based upon their study they had said that "there is a

TABLE 7.6: Comparison of Simulated to Observed Travel in 1980 by Type of Roadway

Type of Roadway	Ratio of Simulated to Observed Vehicle Miles of Travel
1. Expressways	1.03
2. Major Arterials	0.94
3. Minor Arterials	1.02
4. Collectors	1.02
Average for All Roadway Types	1.00

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TABLE 7.7: Comparison of Estimates of Error Between the TRIMS Calibration for 1977 and the EMME/2 Calibration for 1980

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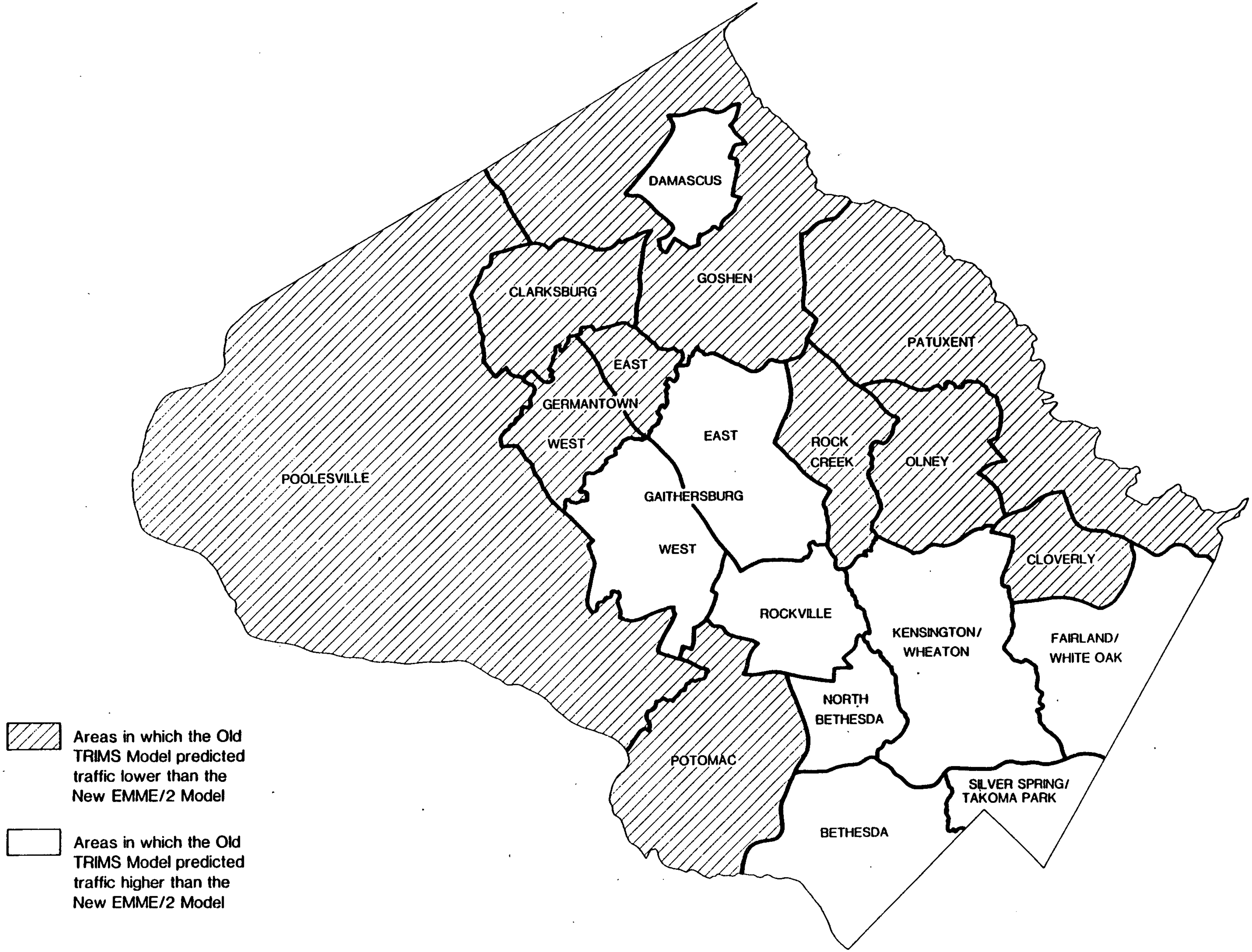
Policy Area or Policy Area Group (#1)	Root Mean Square Error Percentages (Comparing Simulated to Observed Traffic Volumes)	
	TRIMS Calibration For 1977 (#2)	EMME/2 Calibration for 1980 #(3)
BETHESDA	24	28
CLOVERLY/PATUXENT	37	41
DAMASCUS	67	38
FAIRLAND/WHITE OAK	23	22
GAITHERSBURG (TOTAL)	32	31
GERMANTOWN (TOTAL)	39	20
KENSINGTON/WHEATON	33	24
NORTH BETHESDA/ROCKVILLE	28	29
OLNEY	52	36
POOLESVILLE	67	23
POTOMAC	52	29
ROCK CREEK	53	28
SILVER SPRING/TAKOMA PARK	24	22
Average for Montgomery County	30	28

#1: Some of the policy areas, such as Gaithersburg, are shown group because the TRIMS calibration was done prior to expansion of th number of Policy Areas.

#2: Uses Average Daily Traffic with both directions combined togeth

#3: Use AM peak hour directional volumes, and considers only those links with observed volumes greater than 300 vph in the AM peak hour.



Map 7.3 A Comparision of the Results of the TRIMS and EMME/2 Models When Using the Same Inputs

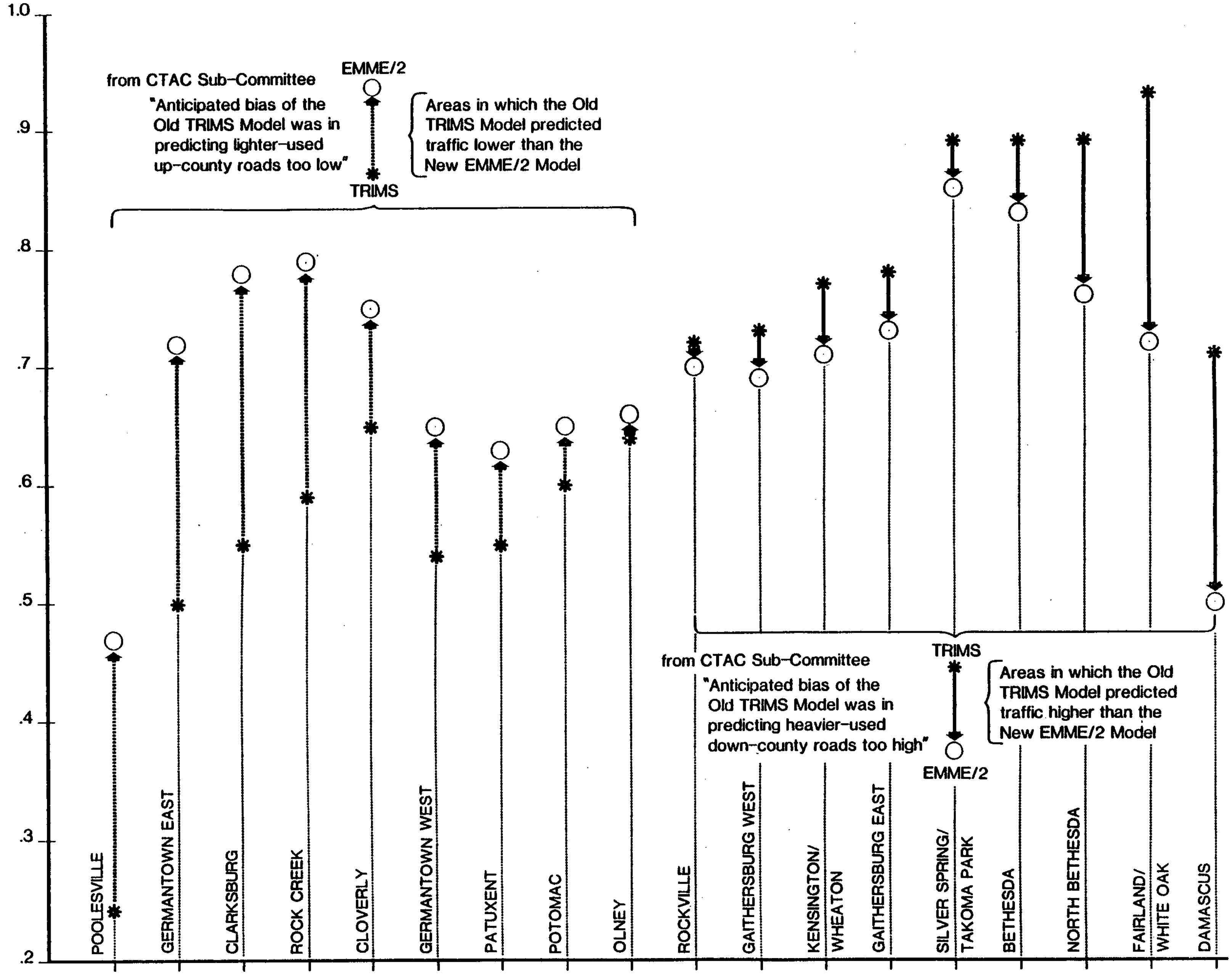


Figure 7.8 A Comparision of the Results of the TRIMS and EMME/2 Models by Policy Area When Using the Same Inputs

definite bias (in the TRIMS model) toward forecasting lighter used roads up-County too low and heavier used roads down-County too high".

The information used to prepare Map 7.3 is presented in Figure 7.8 in order to give a general indication of how much higher or how much lower the TRIMS model system predicted, compared to the EMME/2 model system. In Figure 7.8, information for each of the policy areas is shown where the policy areas have been arranged from left to right according areas which most relatively underpredict to those which most relatively overpredict. The one area that appears to not fit the general pattern is Damascus. As previously shown in Table 7.7, the Damascus Policy Area was tied with Poolesville as being the least well simulated with the TRIMS model. Both models have more difficulty matching observed volumes for areas at the edges of the County that have lighter used roads, and less certain observed volumes. We are not certain why the Damascus area seems to be at odds. However, it is felt that the greater number of links in the network in that area, and a better accounting for through traffic by the new EMME/2 model system, results in a more accurate and reliable simulation.

As time and data availability permit, further refinement and calibration of the M-NCPPC EMME/2 model system will proceed. To provide a better basis for model refinement, the M-NCPPC has commissioned the Metropolitan Washington COG to significantly expand in Montgomery County the size of the household travel survey it is conducting in 1987. Work is already proceeding on a more detailed subarea model system to provide better analysis of transportation and land use alternatives for master planning areas within the County. To provide better information on traffic speed and delay, the M-NCPPC has hired a consultant to collect extensive data on traffic conditions in May and June 1987. This data will be incorporated into the model system to enhance the models ability to simulate traffic conditions.

CHAPTER 8

SPECIFIC GUIDELINES FOR APFO

LOCAL AREA TRANSPORTATION REVIEW

CHAPTER 8

SPECIFIC GUIDELINES FOR APFO LOCAL AREA TRANSPORTATION REVIEW

1. Introduction

The intent of these procedures is to permit the Planning Board under certain situations to withhold approval of an application, even though it would not exceed the staging ceiling. If it is demonstrated that the development will produce excessive local traffic congestion then the Planning Board can deny the proposed subdivision. It is equally important for these procedures to be used by the County Executive to develop specific recommendations that could satisfy these local traffic congestion situations in order that the Planning Board could consider granting approval.

2. Criteria for Screening Cases for Local Area Transportation Review

Planning staff will use the following criteria to determine whether the applicant needs to submit information and data on the proposed subdivision to carry out Local Area Transportation Review. The applicant will be required to submit a transportation statement concerning the need for their submitting a Local Area Transportation Review. If a Local Area Transportation Review is required it must be filed as a part of the subdivision submittal. The Transportation staff will review the transportation statement and notify the applicant at the Subdivision Review Committee if the statement or Local Area Transportation Review is complete. If the development review staff determines by these screening criteria that a Local Area Transportation Review is necessary, but one was not submitted with the original application, the developer's application filing date will be adjusted to reflect when the Local Area Transportation Review was submitted and considered complete. There are three areas where there are exceptions or additions to the normal Local Area Review process:

1) "Bethesda Policy Area" development located within the Bethesda Sector Plan area will be reviewed in accordance with the staging element recommendations of the Bethesda Sector Plan.

2) "Potomac Policy Area" development will be reviewed in accordance with the adopted Master Plan for the Potomac Subregion. The area contributing traffic to the intersection of Montrose Road and Seven Locks Road will be subject to local area transportation review.

3) "Gaithersburg Policy Area" development located within the Shady Grove West area, as defined in the Gaithersburg Vicinity Master Plan, will, in addition to Local Area Review, be subject to restrictions or recording in accordance with the staging plan contained in the Master Plan.

A Local Area Transportation Review is required if the combination of the conditions identified in the following paragraphs is A and B, A and C, or all three:

A. Significantly Sized Project: The proposed development is of sufficient size to have a measurable impact on a specific local area to be considered in a local review. This is taken to mean either a standard of fifty or more dwelling units in the proposed development or a nonresidential development which would generate fifty or more peak-hour trips. The number of trips shall be calculated with the appropriate rates and category in the Institute of Transportation Engineers Trip Generation Handbook or by other trip generation rates adopted by these guidelines. It is recognized that in the actual Local Area Transportation Review it could be determined that a different trip generation rate may be more appropriate. With regard to smaller sized subdivisions it is presumed that they can only be considered in the area-wide aggregate review which constitutes the staging ceiling.

In determining whether or not a total of 50 or more trips are involved for the purpose of applying the requirements of Local Area Review, all peak hour trips are to be counted even if some of the trips are estimated to be diverted to the site from existing traffic.

In determining whether or not a total of fifty or more dwelling units or trips are involved for the purpose of applying the requirements of Local Area Transportation Review, all land at one location within the County including existing development or available for building development under common ownership or control by an applicant, including that land owned or controlled by separate corporations in which any stockholder (or family of the stockholder) owns ten percent or more of the stock, shall be included. An applicant shall not avoid the intent of this requirement by submitting piecemeal applications or approval requests for subdivision plats, site or development plans, or building permits. Any applicant may submit a preliminary subdivision plat for approval for less than fifty dwelling units or fifty peak-hour trips at any one time provided such applicant must agree in writing that upon the next such application, or request, the applicant will comply with the requirements of Local Area Transportation

Review when the total number of requests at one location has reached fifty or more dwelling units or fifty or more trips.

The phrase "at one location" means all adjacent land of the applicant, the property lines of which are contiguous or nearly contiguous at any point, or the property lines of which are separated only by a public or private street, road, highway, or utility right-of-way or other public or private right-of-way at any point, or separated only by other land of the applicant, which separating land is not subject to the requirements of Local Area Transportation Review at the time of application for preliminary subdivision plat approval.

Plans for more than 50 dwelling units or 50 peak-hour trips which cannot pass Local Area Transportation Review may be conditionally approved such that the development which may proceed to record plat will produce less than 50 dwelling units or 50 peak-hour trips. When the applicant can demonstrate that the full plan, as submitted, including those lots which have been approved for recording, has adequate public facilities for all facilities, then the remainder of the preliminary plan will be able to obtain record plat approval.

B. <u>Nearby Congestion</u>: The proposed development is located near roadways, intersections, or sets of intersections which are already heavily congested. This is taken to mean a standard of having a critical intersection or highway link operating at Level of Service D or lower in the vicinity of the proposed development. The Transportation Planning Division shall maintain an Intersection Level of Service Inventory based upon traffic counts collected primarily by the MCDOT. The inventory gives the most congested level of service conditions for a one-hour period either in the A.M. or P.M. In addition, the SHA periodically conducts aerial surveys which develop estimates of level of service conditions along major state highways, as well as their interchanges or intersections.

C. <u>Development Level Approaching the Staging Ceiling:</u> The proposed development is added to: (1) completions since the staging ceiling base year, and (2) all approved subdivisions. If the resulting total development is within 5 percent of the approved staging ceiling for the area, then this condition for a local area review is met. As an example, if the staging ceiling for an area is 2,000 households, and if the sum of the housing completions, all approved subdivisions and the proposed subdivision is greater than 1,900, then this condition is met.

3. <u>Findings for Inadequate Facilities</u>

The Planning Board staff report will present findings for each of the categories identified below and give a recommendation relating to the adequacy of the transportation facilities. The Planning Board will use these findings, as well as comments and recommendation from the County Executive, to make its overall findings as to adequacy of public facilities for the proposed development.

A. Transportation Solutions: If the developer's local area transportation review identifies a local area problem, staff will notify the developer and County Executive of the problem so that they can work together to develop a solution to resolve the problem. Once the developer and the County Executive have identified the degree to which there are remedial transportation solutions to obtain adequate local transportation capacity, these solutions will be brought to the attention of Planning Board staff. These solutions could include additional traffic engineering or operating changes beyond those currently programmed, or nonprogrammed transit or ridesharing activities which would make the overall transportation system adequate.

B. Degree of Local Congestion: Staff will identify the degree of congestion forecasted for both A.M. and P.M. peak hours. Staff will present findings of the degree to which the forecasted traffic exceeds the maximum capacity of the nearby road system. The mid-point of Level of Service E is presumed the condition under which the transportation facilities as a total system are operating at maximum capacity. Critical Lane Volumes higher than the mid-point of Level of Service E are deemed to reduce the overall efficiency of the road network. Because the experience of congestion is felt by road users and adjacent land uses before this level is reached, a judgment must be made in each case regarding the degree of detrimental impact that can be tolerated. The degree of local congestion will be considered to be more severe if both the A.M. and P.M. peak-hour traffic conditions are beyond the mid-point of Level of Service E.

If an applicant agrees to construct a roadway project or provide a transit program which would result in the operating conditions (as measured by critical lane volume) being better than the conditions that would occur without the applicants project, then local congestion will be considered less severe even though the calculated level of service does not meet the standard of acceptability.

C. <u>Unavoidable Congestion</u>: Staff will identify the degree to which there are alternate routes or paths to serve the traffic associated with the proposed development. If there are no appropriate alternate routes for that traffic to use to avoid the congestion, then it must be assumed that traffic from the proposed development will increase the local area congestion. It is not appropriate to anticipate that the traffic associated with the development would use local streets unless those streets have been functionally classified as being suitable for handling that generated traffic.

D. <u>Transit Unavailability</u>: Staff will identify the degree to which transit or ridesharing activities are not available to serve the proposed development. If it is physically or fiscally ineffective for the public agencies to provide transit or ridesharing services, then the local congestion, likely to be caused by the proposed development, cannot be significantly absorbed through the alternative mode of travel. If there is sufficient potential for serving the proposed development with transit or ridesharing services, then it is possible that a transit alternative could be developed for modifying the demand contributing to the severe congestion.

E. <u>Project Related Traffic</u>: Staff will identify the degree to which the congestion problem is directly attributable to the proposed development. Traffic from three sources will be measured: (1) existing traffic, (2) traffic which would be generated by the sum total of all outstanding but unbuilt approved subdivisions; and (3) traffic which would be generated by the proposed development itself. The more that traffic from the proposed development contributes to the congestion problem, the greater the severity of the local impact.

4. <u>Method and Preparation of Local Area Transportation Review</u>

The following general criteria and analytical techniques are to be used by applicants in submitting information and data to demonstrate the expected impact on public roadways by the residents or employees of the proposed subdivision. In addition to the consideration of existing traffic associated with present development, the applicant shall include in the analysis potential traffic which will be generated by his subdivision and other "nearby" recorded lots and approved subdivisions to be included in the analysis. The local area review analysis for the proposed preliminary plan under consideration must include in background traffic all preliminary plans approved by the Planning Board more than two weeks prior to the submission of a preliminary plan application or traffic study, whichever is later. The traffic study should be submitted to the Development Review Division along with the preliminary plan application. Information and

data on other "nearby" recorded lots and approved subdivisions will be supplied to the applicant upon request.

If more than six months elapse between the date the traffic study is submitted and the first date for which the plan is scheduled for review by the Planning Board, the applicant must update the traffic study to include any additional subdivisions approved since the original submission. If a delay of more than six months occurs because there is no available staging ceiling, the applicant has 30 days after new staging ceiling capacity becomes available to submit an updated traffic study. If an updated study is not submitted within 30 days, the plan loses its place in line and its new application date will be the date the updated traffic study is eventually submitted.

In situations where there is available staging ceiling capacity and more than six months elapse between the date of the Subdivision Review Committee (SRC) meeting and the first date the plan is scheduled for a Planning Board meeting, the application will lose its place in line and the new application date will become the date that an updated traffic study is submitted. If the applicant believes that the six months have elapsed because of governmental delays beyond his control, he may request and, the Planning Board may approve, an extension of the six month period.

At a meeting with transportation staff, the following aspects of the traffic impact analysis will also be agreed upon:

1) which intersections are to be included in the traffic impact analysis;
2) adequacy of available turning movement counts and need for additional data;
3) period of analysis (A.M. or P.M. or both);
4) trip generation rates, especially for commercial development;
5) directional distribution of site-generated and platted traffic;
6) mode split assumptions;
7) programmed projects to be considered in the analysis, along with techniques for estimating traffic diversion to major new programmed facilities;
8) link adequacy and trends in traffic growth; and
9) feasible range of traffic engineering improvements associated with implementing the development.

5. <u>Methods for Assigning Values to Key Factors</u>

A. <u>Capital Improvements Program Definition</u>: If the applicant finds it necessary or appropriate in the preparation of the traffic study to incorporate programmed transportation improvement then they must rely upon the Approved Road Program (ARP) to identify which roads are defined as being programmed. The ARP is a list published at least twice a year by the County Executive

that shows all roadway improvements that are contained in the CIP or CTP and indicates which projects may be used in conducting a Local Area Transportation Review. For a project to qualify to be used in a Local Area Transportation Review, the project must meet two criteria: (1) 100 percent of the construction funds need to be already appropriated, and (2) the start of construction needs to be shown in the ARP as being within a two year (24 months) time period.

B. <u>Trip Generation</u>: Trip generation rates for several land use categories are shown in the accompanying table. Rates for other land uses or zoning classifications can be obtained from sources such as recent compilations assembled by the Institute of Transportation Engineers and will be provided by the Transportation Planning Staff of the Planning Board. Generated trips for development of mixed land uses will be determined by combining the trips generated by each of the component uses in the mix. Where it can be demonstrated that peak hours for different land uses occur at different times, the single hour that results in the highest total volume on the street system will be controlling.

Land Use Category	Peak Hour Trip Generation Rates
High Rise Apartments	.5 to .7 trips/housing unit
Townhouses	.6 to .8 trips/housing unit
Garden Apartments	.6 to .8 trips/housing unit
Single-Family	.8 to 1.0 trips/housing unit
General Office	2.00 to 2.82 trips/1000 square feet
Shopping Centers	0.61 to 14.42 trips/1000 square feet

C. <u>Peak Hour</u>: The applicants shall use the peak one-hour period which occurs during either the 7-9 A.M. or 4-6 P.M. periods or both, as agreed to by the staff and applicant.

D. <u>Trip Distribution</u>: The directional distribution of the generated trips entering and leaving the proposed subdivision via all access points must be justified by the relative locations of other traffic generators (i.e., employment centers, commercial centers, regional or area shopping centers, transportation terminals, or the trip table information provided by staff). These same factors or other factors provided by the Subdivision Review Committee shall be applied to the development under study as well as the other "nearby" subdivision plans in their analyses.

E. Directional Split: Trips generated by residential uses will be assumed to have 60-70 percent leaving and 30-40 percent entering the proposed subdivision during the morning peak and 60-70 percent entering and 30-40 percent leaving the proposed subdivision in the evening peak. The split for traffic associated with other land uses is to be derived from ITE published information or other accepted studies, as determined by the transportation planning staff and the applicant.

F. Trip Assignment: The distribution factors shall be applied to the generated trips and the resulting traffic volumes assigned to the road network providing access to the proposed subdivision plus existing and "nearby" future traffic to determine the impact on the adequacy of the transportation facilities. The assignment is to be extended to the nearest major intersection, or intersections, as determined by the Subdivision Review Committee and can include an evaluation of the impact of generated traffic on existing links.

G. Critical Lane Analysis: At the identified major intersection, or each such intersection, the existing and generated traffic is to be related to the adequacy of the intersection by using the "Critical Lane Volume" technique (see section J) which shall be updated to maintain consistency with the Highway Capacity Manual revisions. Link volume analysis shall also be related to Highway Capacity Manual standards. The analysis should be carried out for both the A.M. and the P.M. peaks and should use traffic data for non-holiday weekdays. If so desired, alternate capacity and level of service analysis techniques can be used to develop supplemental information.

H. Traffic Data:

1. Traffic volume data is available from either the Maryland Department of Transportation or the Montgomery County Department of Transportation.

2. Data should be adjusted to the current year or new counts should be made by the applicant if, in the opinion of staff, traffic volumes have increased due to some change in the traffic pattern, such as the completion of a development project after the count was made. Counts older than six months must be made current by adding estimated new residential and commercial construction completed since the date the count was made.

3. If turning movement data is older than three years, or if there are locations for which data is

non-existent, data must be acquired by the applicants using their own resources. This is in accordance with the ordinance and part of the applicant's submission of sufficient information and data, consistent with the decisions reached by the Subdivision Review Committee and Transportation Planning Staff.

4. Intersection traffic counts conducted by the applicant must be manual turning movement counts covering the periods of 7-9 A.M. and 4-6 P.M. so as to allow selection of the peak hour within the nearest thirty minutes (e.g., 4:00-5:00, 4:30-5:30, or 5:00-6:00). Inclusion of all 7-9 A.M. and 4-5 P.M. turning movement data is required to be submitted as part of the applicant's traffic impact analysis.

I. Adequate Accommodation of Traffic: The ability of a highway system to carry traffic is expressed in terms of "Level of Service" at the critical locations (usually intersection). "Level of Service" is defined alphabetically as follows:

"A" Conditions of free unobstructed flow, no delays and all signal phases sufficient in duration to clear all approaching vehicles.

"B" Conditions of stable flow, very little delay, a few phases are unable to handle all approaching vehicles.

"C" Conditions of stable flow, delays are low to moderate, full use of peak direction signal phase(s) is experienced.

"D" Conditions approaching unstable flow, delays are moderate to heavy, significant signal time deficiencies are experienced for short durations during the peak traffic period.

"E" Conditions of unstable flow, delays are significant, signal phase timing is generally insufficient, congestion exists for extended duration throughout the peak period.

"F" Conditions are jammed, full utilization of the intersection approach is prevented due to back-ups from locations downstream.

J. "Critical Lane Volume" Technique: A technical description of the "critical lane volume" technique is given in the January 1971 issue of Traffic Engineering. The following step-by-step procedure should be sufficiently descriptive to enable the applicant to utilize the

technique at simple two-phase or unsignalized intersections.

The peak hour approaching traffic volume and turning movements for the intersection being analyzed will be determined in the traffic generation and trip distribution phase of the analysis. At unsignalized intersections, a two-phase operation should be assumed.

<u>The following is a step-by-step description of how to determine the Level of Service (LOS) for an intersection.</u>

Step 1. Note the number of approach lanes from each direction.

Step 2. Subtract from the total approach volume any right turn volume that operates continuously throughout the signal cycle, (i.e., a free right turn by-pass).

Step 3. Determine the maximum volume per lane from each approach using the following table. (Note: Do not count lanes established for exclusive use such as left turn storage lanes - the lane use factor for exclusive use lanes is 1.00).

Number of Approach Lanes	Lane Use Factor
1	1.00
2	0.55
3	0.40
4	0.30

Step 4 Select the maximum volume per lane in one direction (e.g., northbound) and add it to the opposing (e.g., southbound) left turn volume.

Step 5 Select the maximum volume per lane operating in the opposite direction of the approach selected in Step 4.

Step 6. The maximum total of Step 4 <u>or</u> Step 5 will be the "critical" volume for phase one (e.g., north-south).

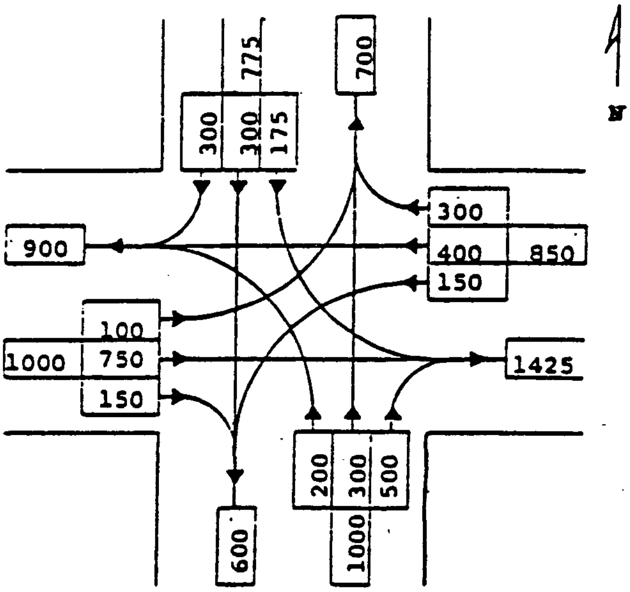
Step 7. Repeat Steps 4 through 6 for lanes operating in phase two (e.g., east-west).

Step 8. Sum the "critical" volumes for each phase.

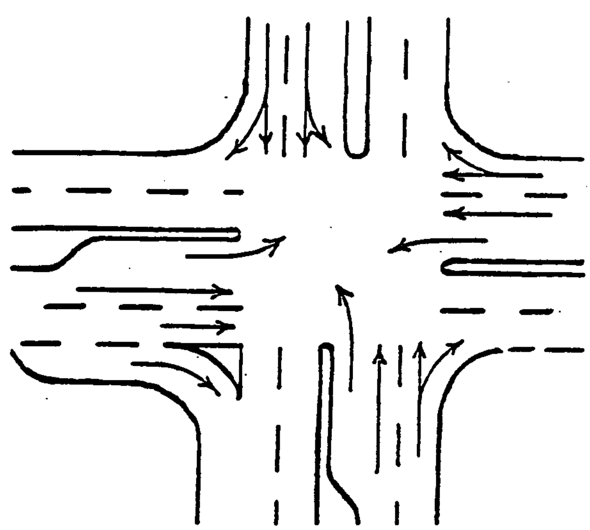
Step 9. Compare the resultant "Critical Lane Volume" for the intersection with the range table on page .

"Critical Lane Volume" Technique Example

TURNING VOLUMES



INTERSECTION GEOMETRICS



From		Approach Volume	Lane Use Factor	Critical Approach Volume		Opposing Lefts		Critical Lane Volume Per Approach
N		775 (1)	0.55	426	+	200	=	626
S		800 (2)	0.55	440	+	175	=	615
S	OR	500	1.00	500	+	175	=	675*
E		700 (3)	0.55	385	+	100	=	485
W		750 (4)	0.55	412	+	150	=	562*

* "Critical Lane Volume" = 675 + 562 = 1,237 vph.
1,237 represents Service Level C (from table on following page).

(1) Approach volume sum of throughs, rights and lefts in two lanes.

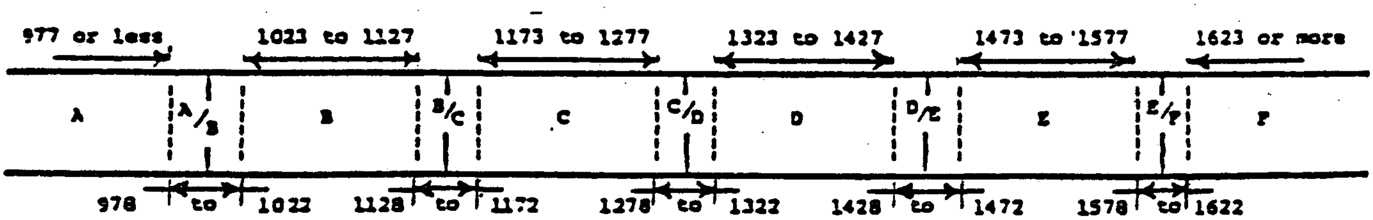
(2) For a heavy right turn, must evaluate worst of rights in one lane or throughs and rights in two lanes.

(3) Approach volume sum of throughs and rights in two lanes.

(4) Approach volume is through only because of free right and separate left.

The following chart indicates the "Critical Lane Volume" ranges to be used in determining "Level of Service" for an intersection. Service level volumes for roadway sections and ramps are described in sections eight through ten of the <u>Highway Capacity Manual</u>.

<u>Intersection Levels of Service by Critical Lane Volume Ranges</u>



K. Items that must be submitted as a part of the local area transportation review: In an effort to standardize what information is submitted in a local area transportation review, the following must be submitted before the preliminary plan application is considered complete when this review is required.

1. A site or area map showing existing roads in the area.

2. The location on the site map of "programmed" highway improvements, if any, that are in the County's Capital Improvements Program (CIP) or the State's Consolidated Transportation Program (CTP), which would affect traffic at the critical intersection(s) to be studied provided that they are in the County's most recently published Approved Road Program (ARP).

3. Existing A.M. and P.M. peak traffic count summaries for all "nearby" critical intersections.

4. "Nearby" approved subdivisions that would affect traffic at the critical intersection(s), with their location shown on the area map.

5. A table giving A.M. and P.M. peak hour traffic generated by all "nearby" approved but unbuilt subdivisions showing the generation rates for each type of subdivision.

6. A.M. and P.M. peak hour traffic generated by the proposed subdivision proportioned to the traffic entering and leaving the site.

7. Trip distribution pattern, in percent, for the "nearby" recorded subdivisions during the A.M. and P.M. peak hour, with the pattern being shown on an area map.

8. Trip distribution pattern, in percent, for the proposed subdivision during the A.M. and P.M. peak hours, with the pattern being shown on an area map.

9. Maps which show separately and in combination.

   (a) Existing A.M. and P.M. traffic volumes assigned to the affected highway system.

   (b) Projected A.M. and P.M. traffic volumes assigned to the affected highway system for all "nearby" approved subdivisions.

   (c) Projected A.M. and P.M. traffic volumes assigned to the affected highway system for the proposed subdivision.

10. Any study performed to help determine how to assign recorded or proposed development traffic, such as a license plate study or special turning movement counts, should also be supplied.

11. Copies of all critical lane analyses, showing calculations for each approach, should be included.

12. A listing of all transportation improvements, if any, that the developer agrees to provide.

APPENDIX

PEAK HOUR TRAVEL TIMES

PEAK HOUR TRAVEL TIMES

AN INITIAL STUDY OF AUTOMOBILE TRAVEL TIMES
TO AND FROM MAJOR EMPLOYMENT CENTERS
IN MONTGOMERY COUNTY

Maryland-National Capital Park & Planning Commission
8787 Georgia Avenue
Silver Spring, Maryland 20910

February 26, 1987

Peak Hour Travel Time Study

During September, 1986, the Maryland-National Capital Park and Planning Commission contracted for surveys to measure automobile travel times during the peak hour to and from major employment centers in Montgomery County. Those surveys represented an "exploratory" study which will serve as a basis of a more thorough project to monitor vehicular travel times and delays throughout Montgomery County.

This booklet contains the basic results of these travel time surveys. The results are given on a series of maps for eight employment centers within Montgomery County as well as on maps for downtown Washington. There are two maps given for each area - one for travel in the morning and the other in the afternoon peak hour. Each map shows a set of "contour lines" radiating out from that particular employment center. There are five minute time intervals between each contour line. At 15,30,45, and 60 minutes bolder lines are shown to facilitate reading the map. The nine generalized employment centers presented in this booklet are as follows:

1) Germantown: at I-270 and Germantown Road (MD 118).

2) Gaithersburg: Frederick Avenue (MD 355) and East Diamond Avenue (MD 117).

3) Rockville: Near the Montgomery County Executive Office Building at Rockville Pike (MD 355) and Veirs Mill Road/Jefferson Street (MD 28).

4) North Bethesda: White Flint Metro Station near Rockville Pike (MD 355) and Old Georgetown Road (MD 187).

5) Bethesda: Wisconsin Avenue (MD 355), Old Georgetown Road (MD 187), and East-West Highway (MD 410).

6) Downtown Washington: Connecticut Avenue and L Street, N.W.

7) Silver Spring: Georgia Avenue (MD 97) and Colesville Road (US 29).

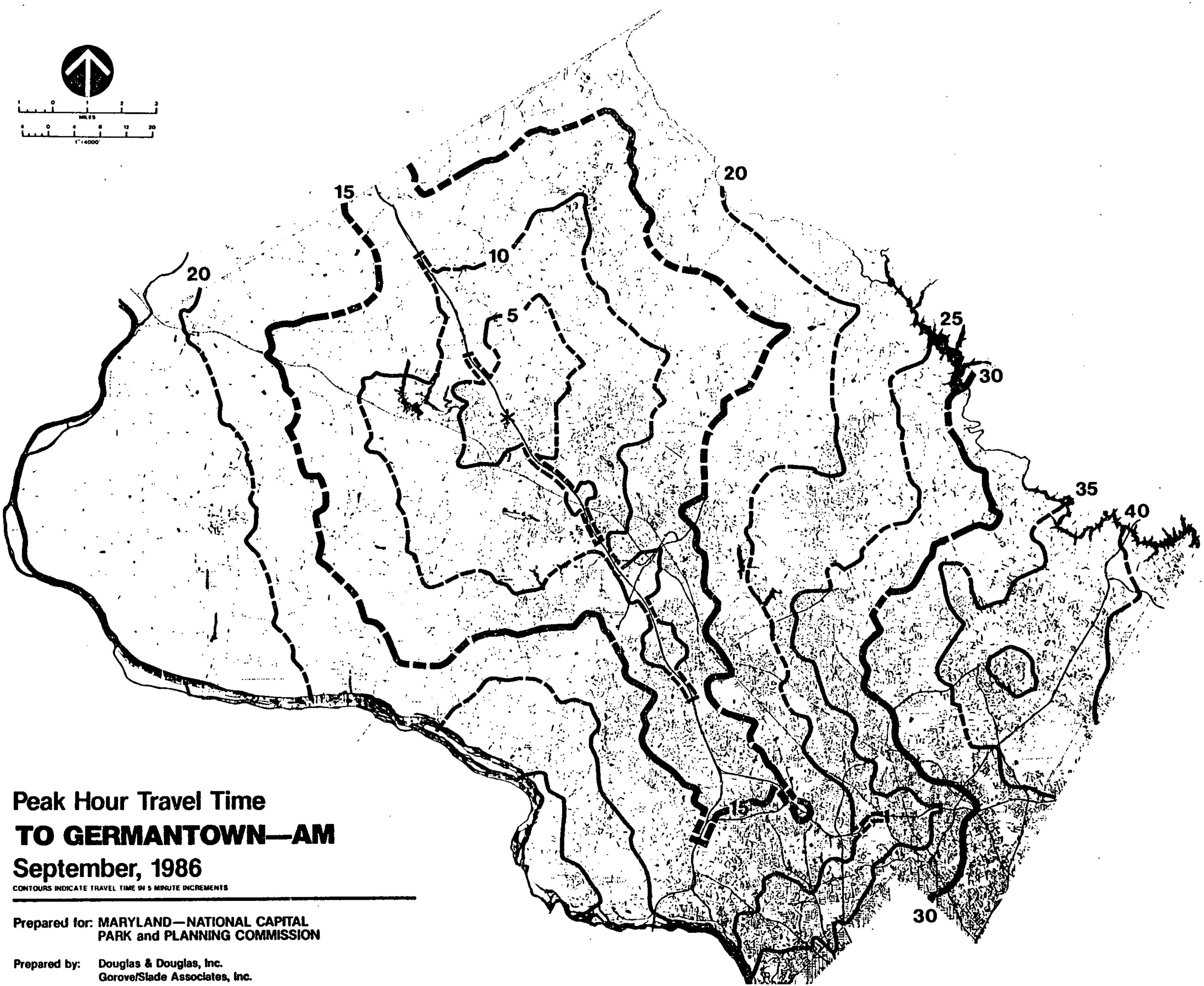
8) Wheaton: University Boulevard (MD 193), Georgia Avenue (MD 97), and Veirs Mill Road (MD 586).

9) Fairland: Columbia Pike (US 29) and Fairland Road.

In examining the maps, it should be noted that where the contour lines are closer together, the motorists are traveling slower. Where the contour lines project outward in the form of a very narrow and long "fingers", motorists tend to be traveling much faster along limited access highways, such as, the Beltway and I-270, than on surrounding local streets. In some cases, the contour lines may form a circle or near circles giving the appearance of an "island." This is because motorists can travel faster by staying on major highways, exiting after their destination, and then backtracking rather than traveling directly to their destinations on local roads. Finally, where local roads which do not intersect but cross over a limited access highway, the travel time contour line will extend past the highway for a short section.

The travel times were measured as "in-vehicle" travel times. Additional time must be added for vehicle parking and walking to one's destination if comparing these travel times to actual experience. The surveys were conducted to have motorists arriving at each center in the AM peak hour between 8:30 and 9:00 AM and leaving in the PM peak hour between 4:30 and 5:00 PM. Since this is an initial study and there were only a few travel time runs per survey route, an error of estimate of up to five minutes may be possible as one moves out through the contours. In addition because of many large undeveloped areas in the County, a dashed line was drawn where the motorist could not drive because no public road exists in that area. In some instances, the survey vehicles traveled at the rate of speed of the surrounding traffic which may have been somewhat in excess of the posted speed limits.

This and similar data to be subsequently collected will be summarized and analyzed in other ways to provide information for the Montgomery County Planning Board's ongoing planning and growth management activities. Should you have any comments or questions on this booklet or its contents, please write to the Transportation Planning Division, at the address shown on the cover, or telephone 495-4525 to speak to the appropriate staff.



Peak Hour Travel Time

TO GERMANTOWN—AM

September, 1986

CONTOURS INDICATE TRAVEL TIME IN 5 MINUTE INCREMENTS

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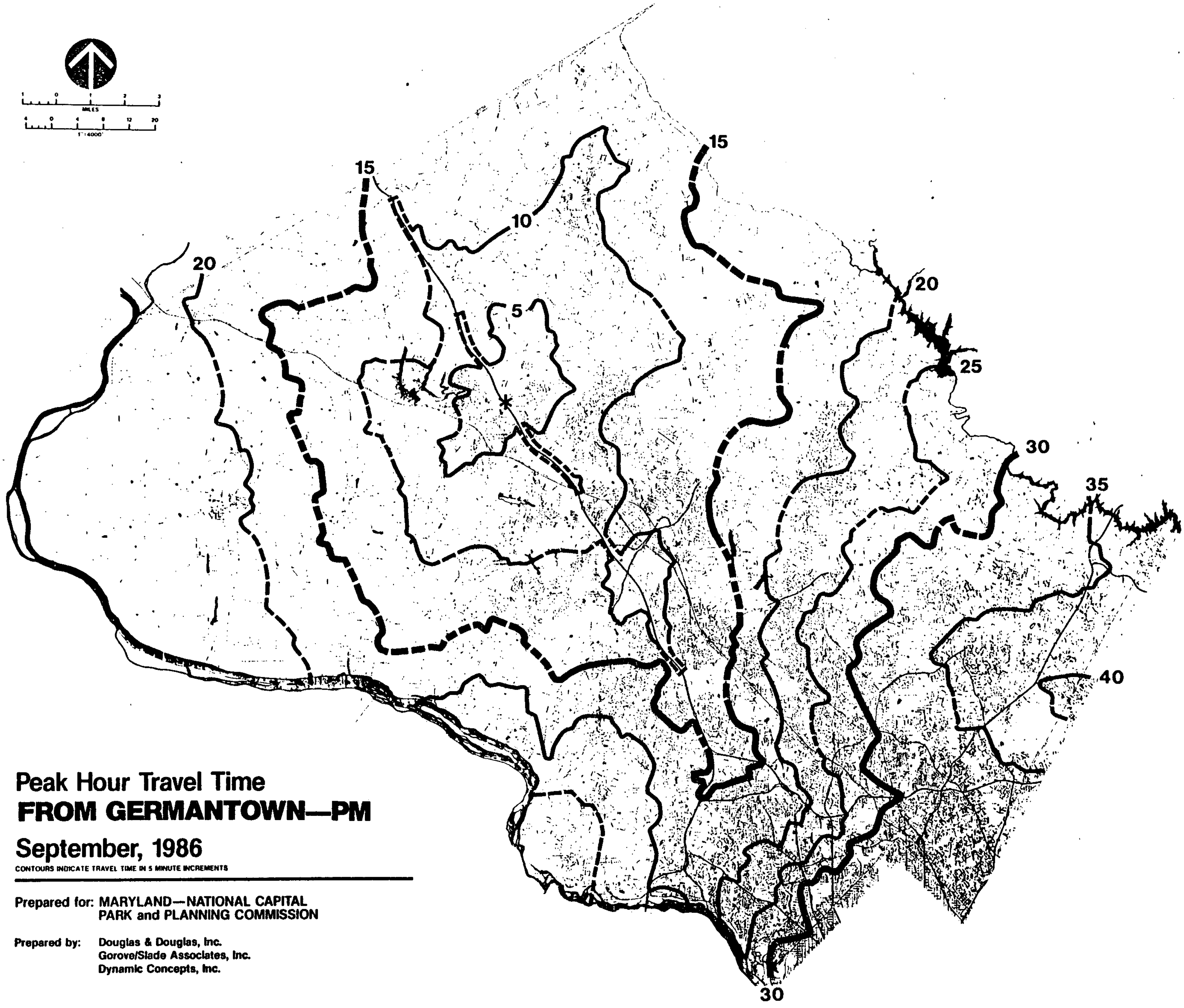
Prepared by: Douglas & Douglas, Inc.
Gorove/Slade Associates, Inc.



Peak Hour Travel Time
FROM GERMANTOWN—PM
September, 1986

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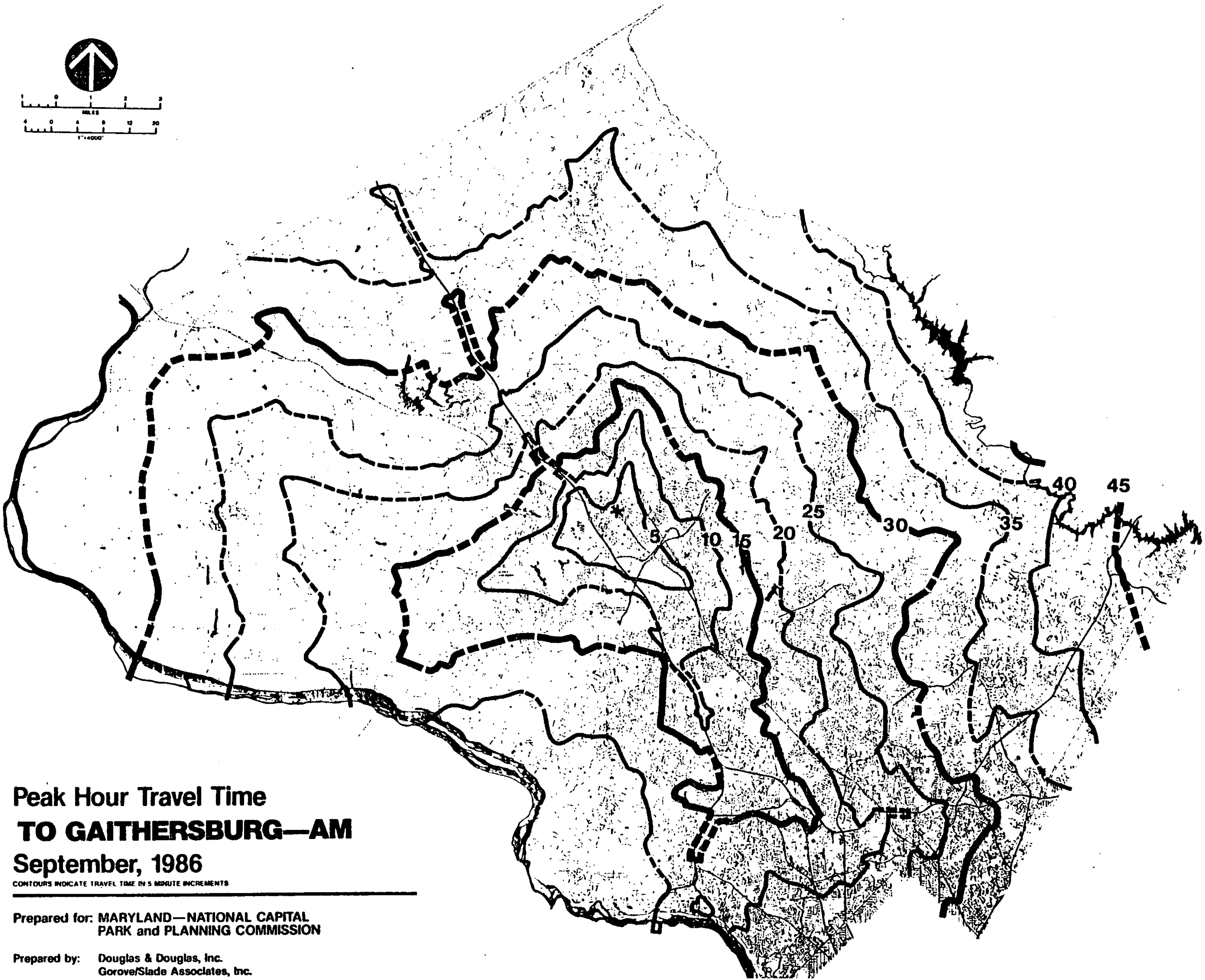

Peak Hour Travel Time

TO GAITHERSBURG—AM

September, 1986

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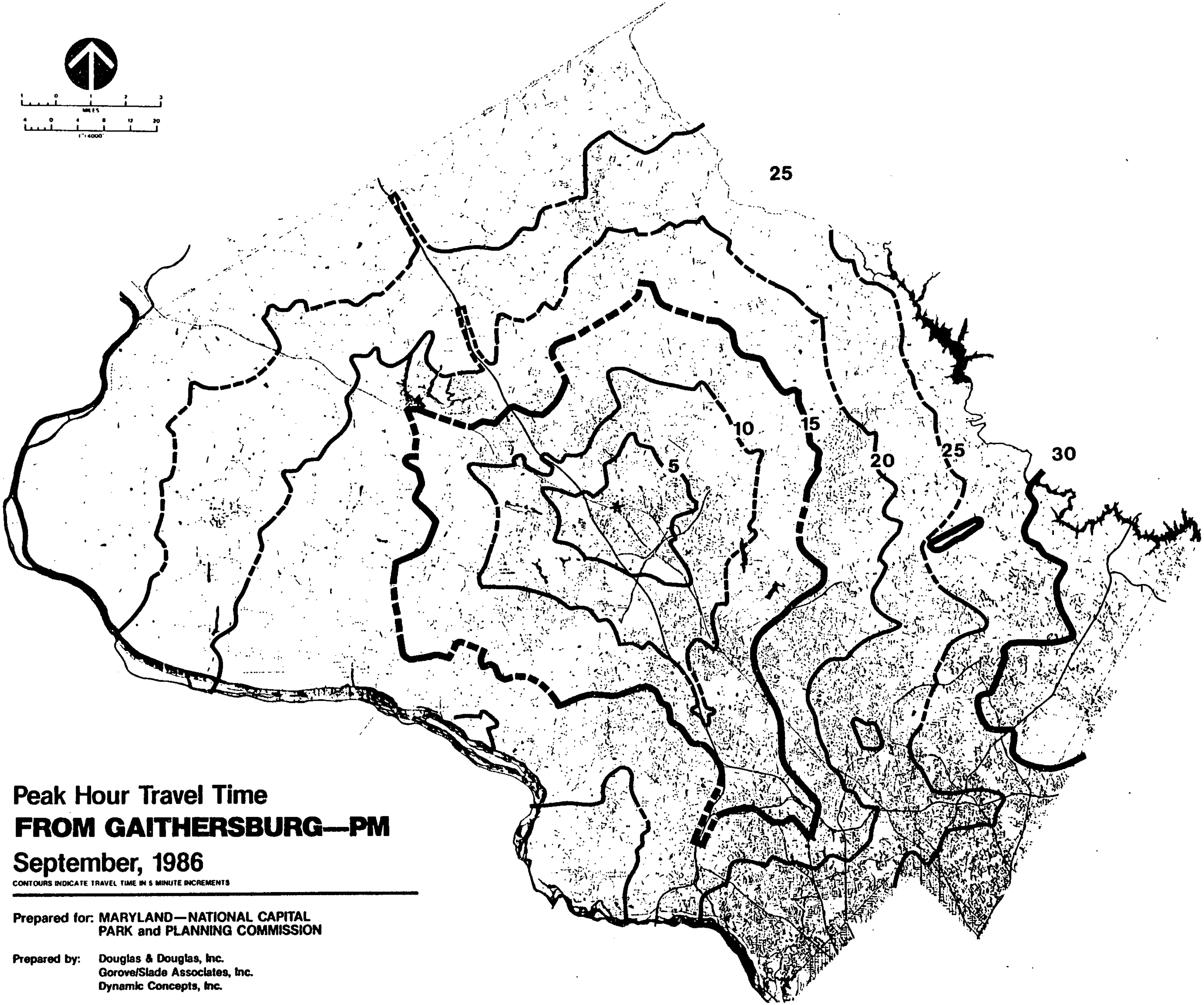

Peak Hour Travel Time
FROM GAITHERSBURG—PM
September, 1986

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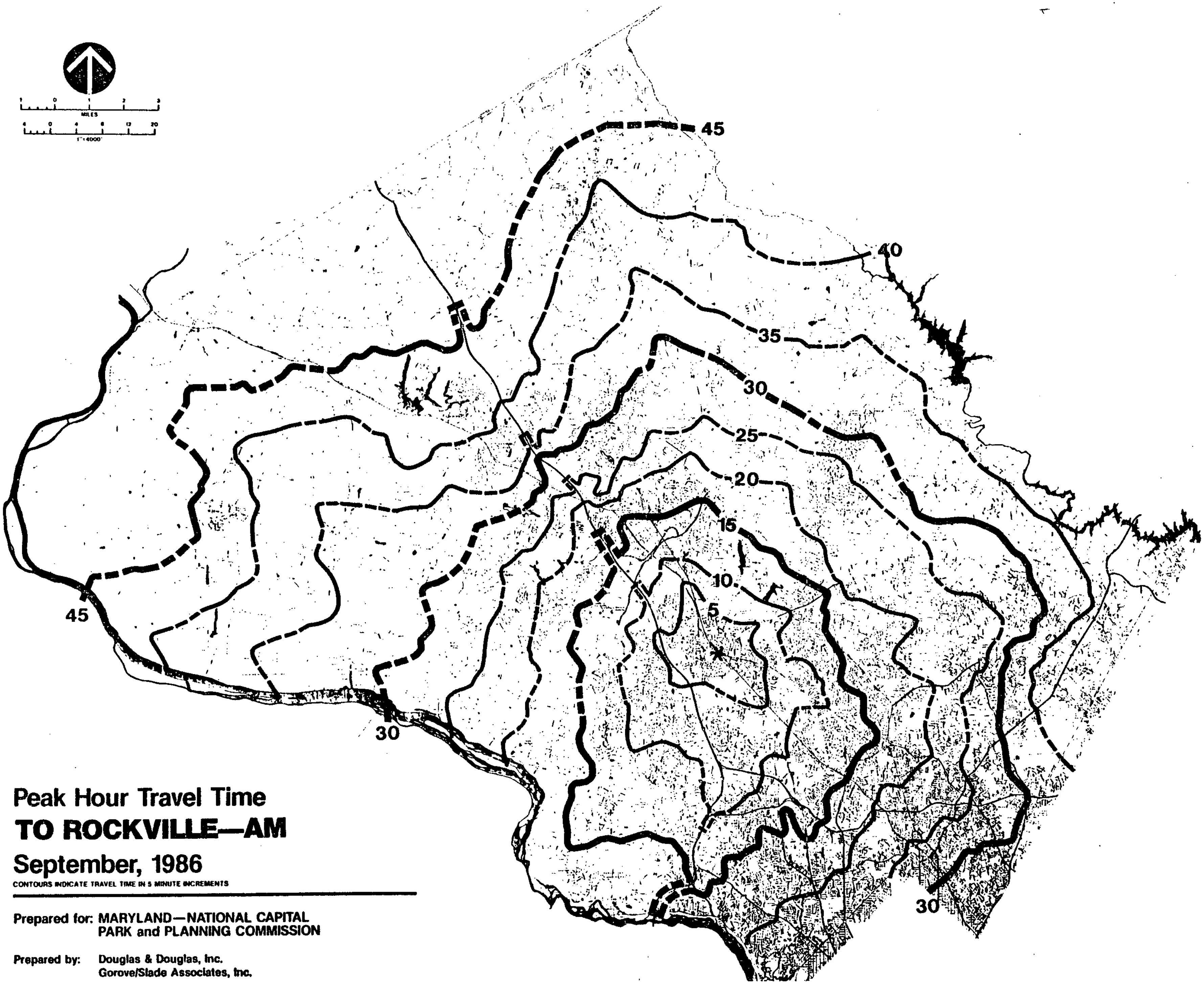

Peak Hour Travel Time
TO ROCKVILLE—AM
September, 1986

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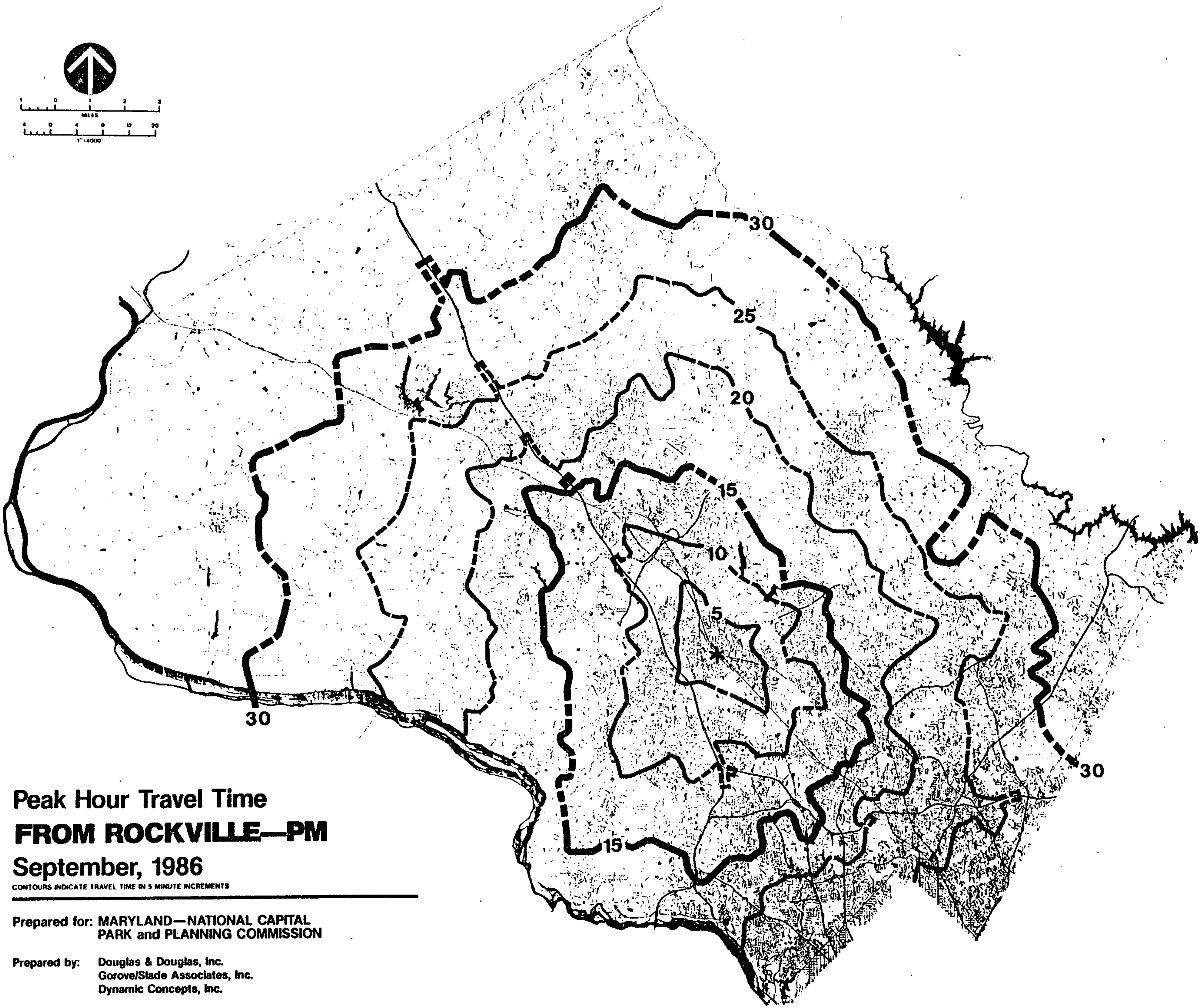

Peak Hour Travel Time
FROM ROCKVILLE—PM
September, 1986

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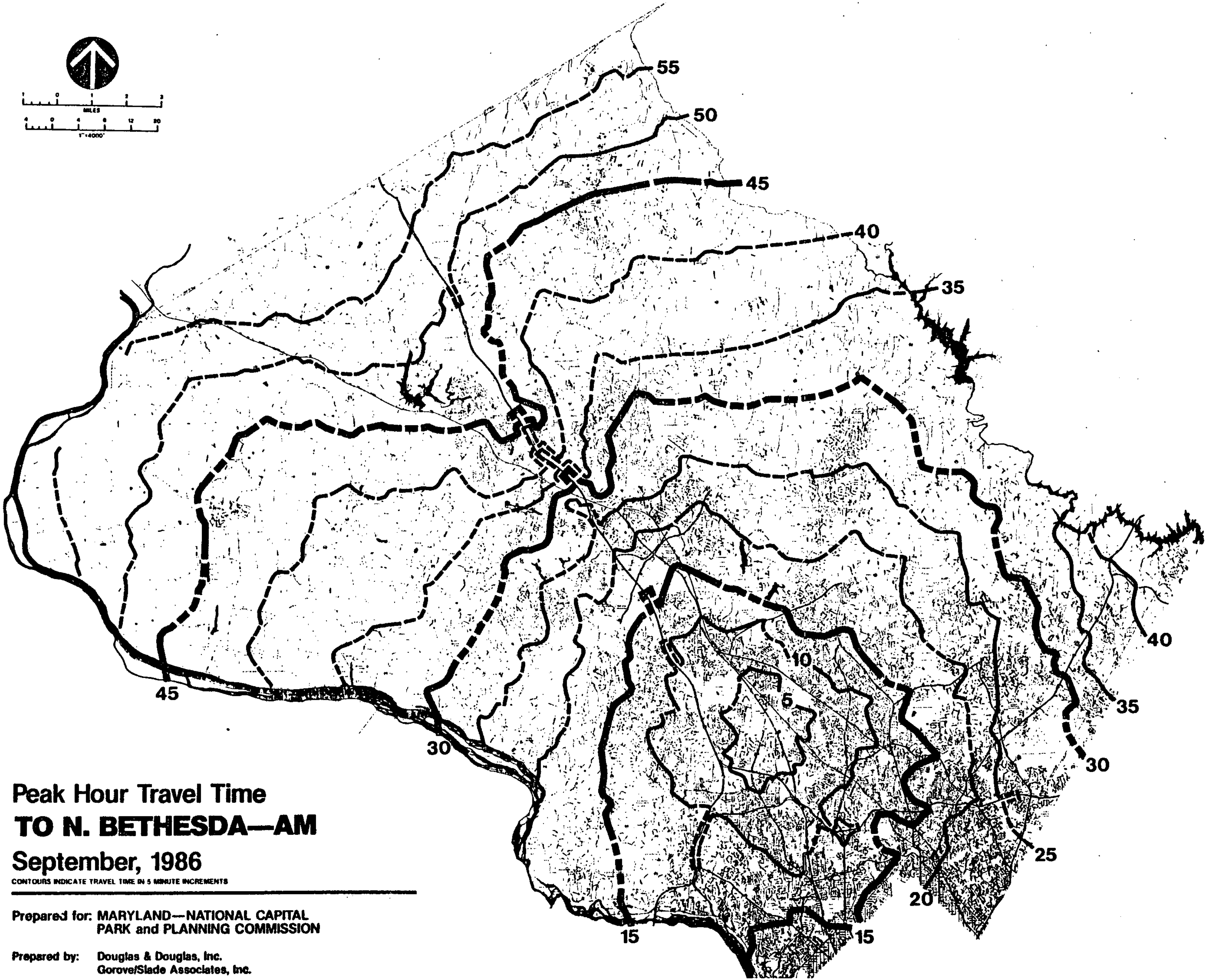

Peak Hour Travel Time
TO N. BETHESDA—AM
September, 1986

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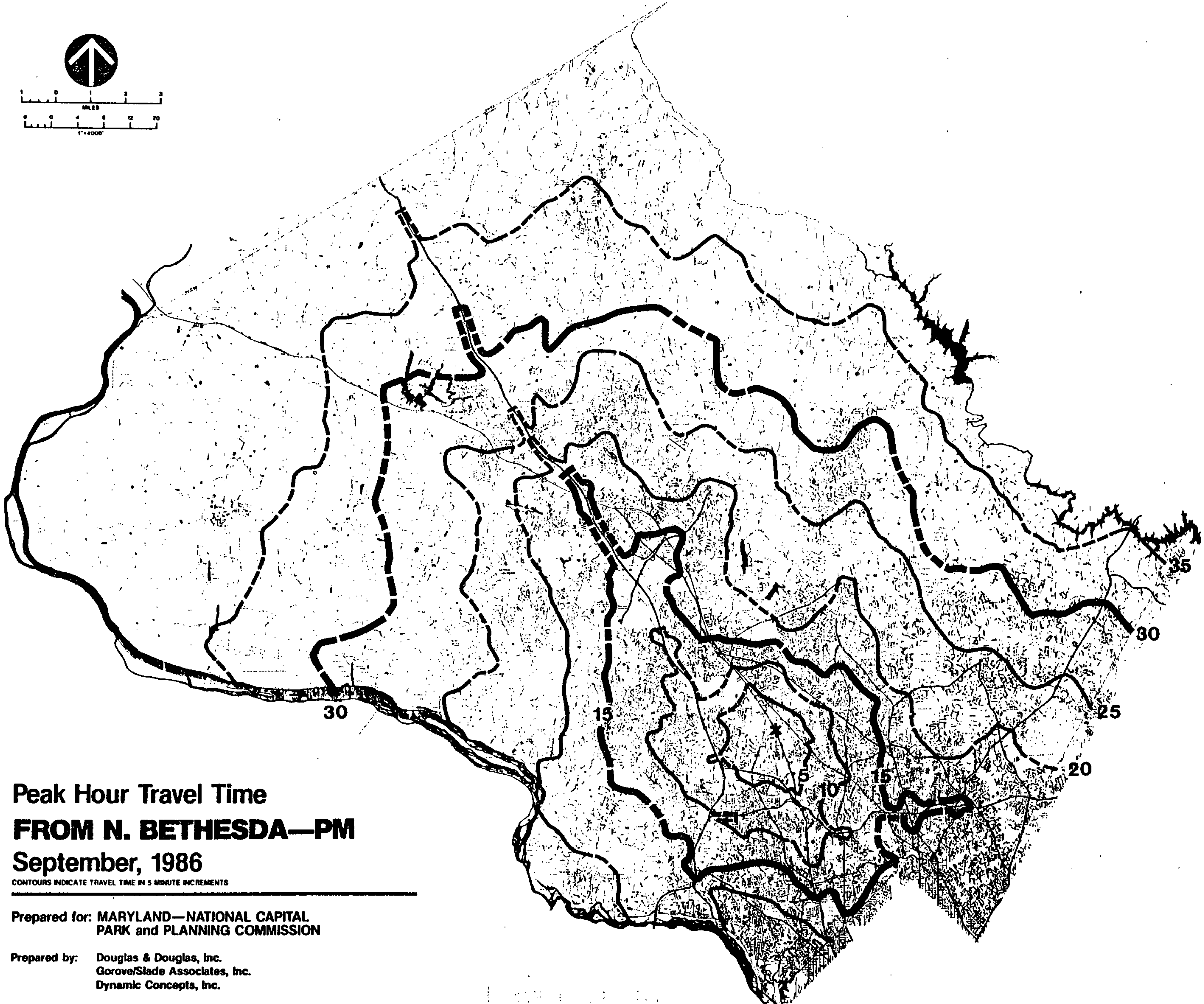

Peak Hour Travel Time

FROM N. BETHESDA—PM

September, 1986

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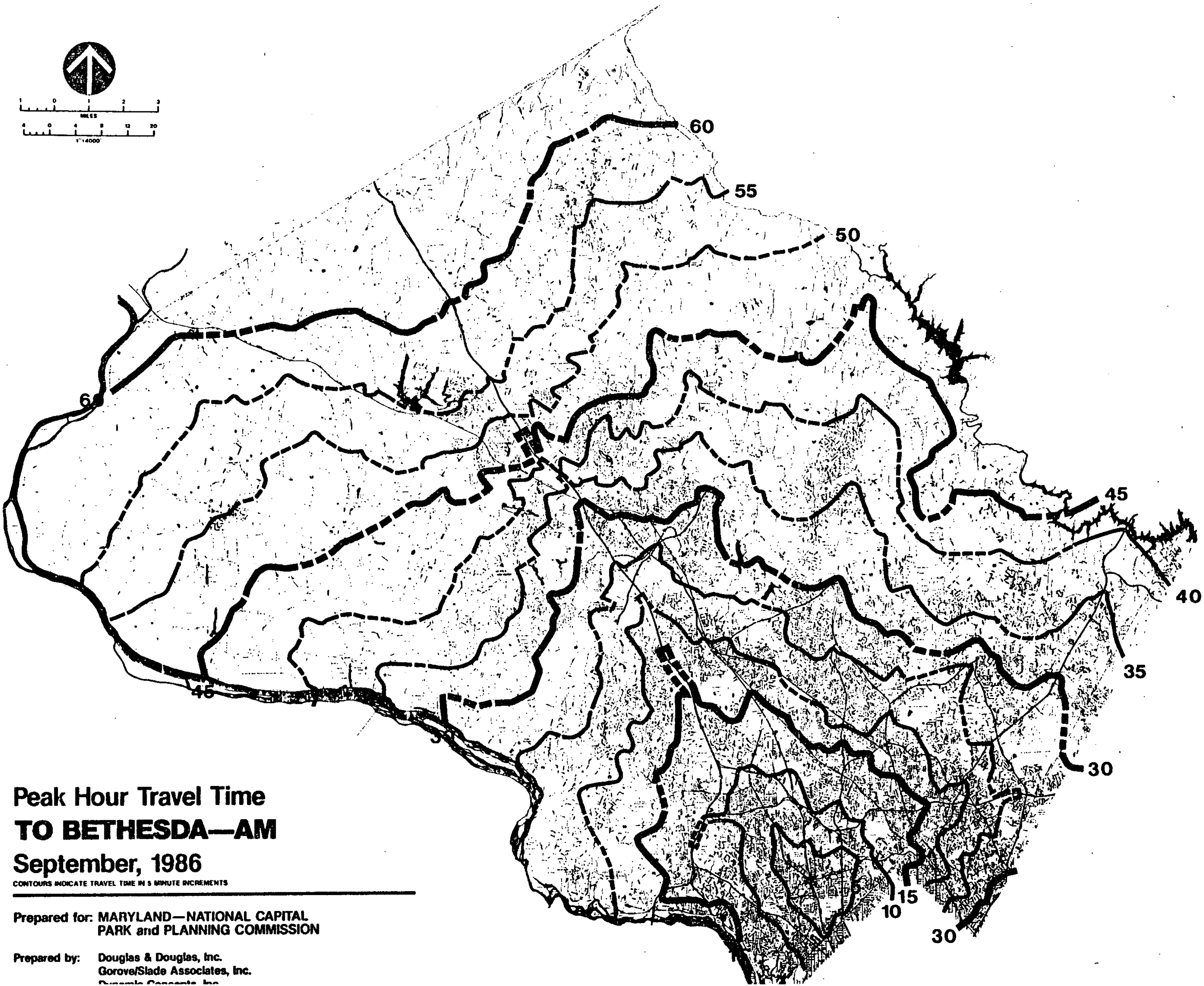

Peak Hour Travel Time
TO BETHESDA—AM
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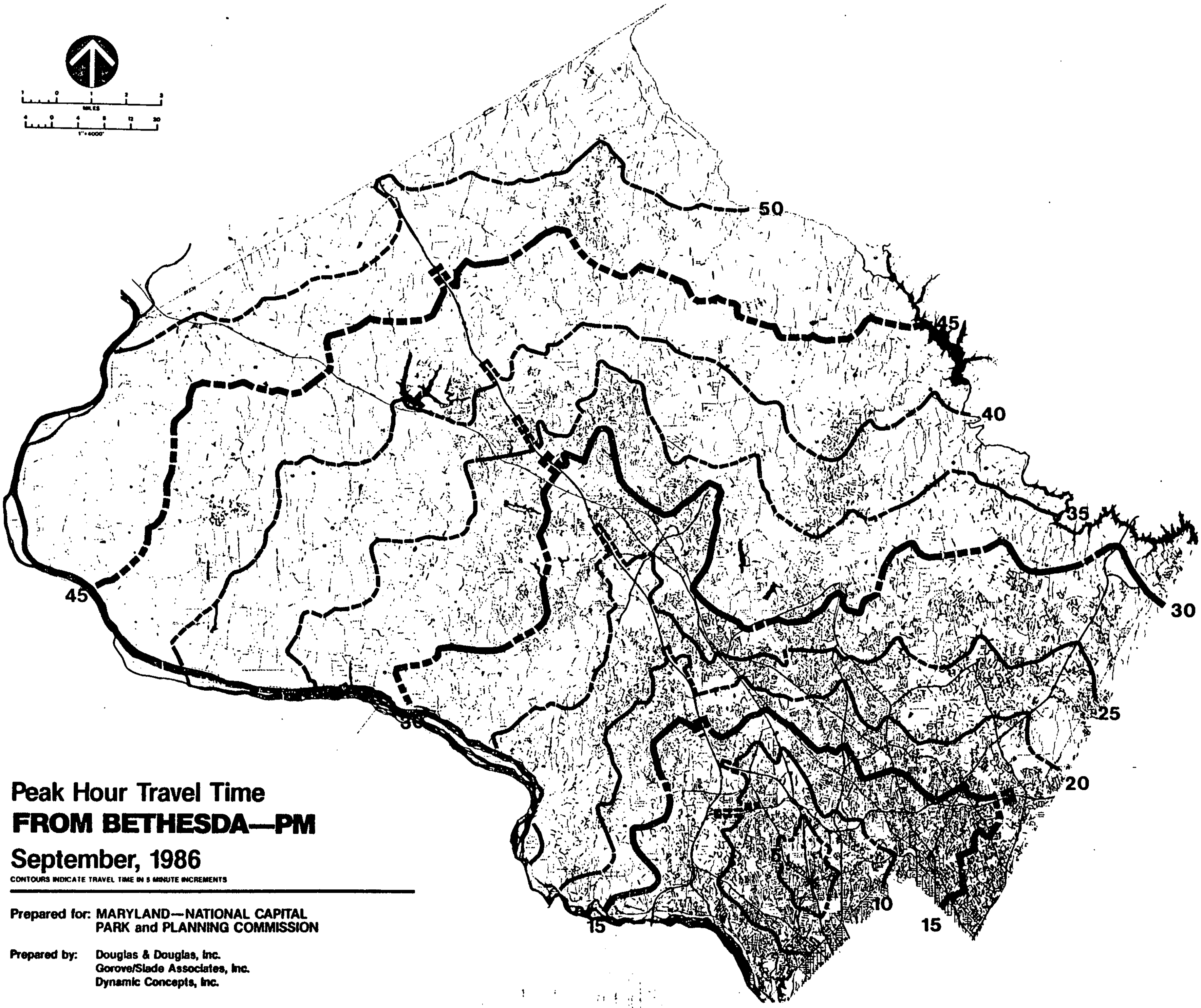

Peak Hour Travel Time
FROM BETHESDA—PM
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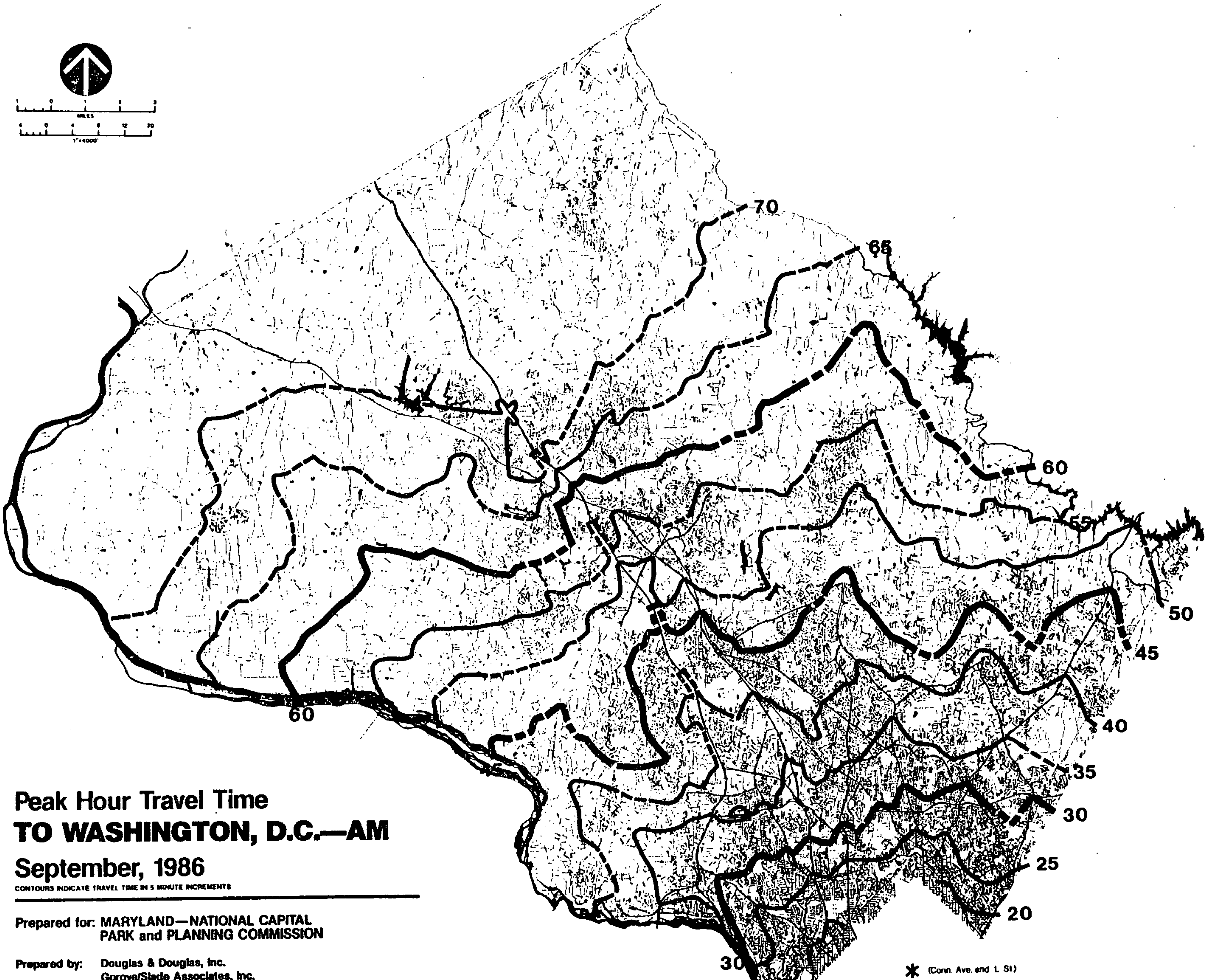

Peak Hour Travel Time
TO WASHINGTON, D.C.—AM
September, 1986

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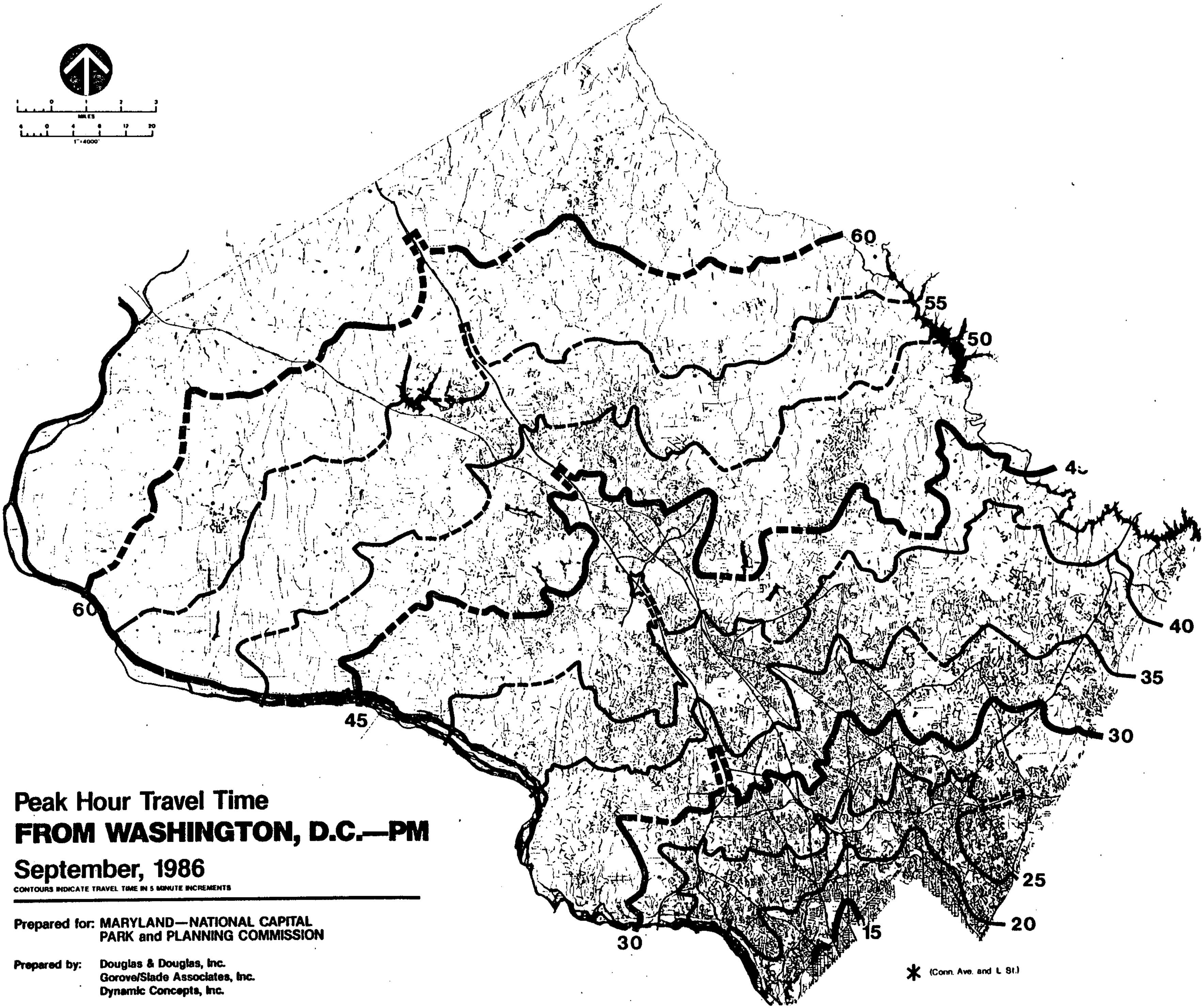

Peak Hour Travel Time
FROM WASHINGTON, D.C.—PM
September, 1986

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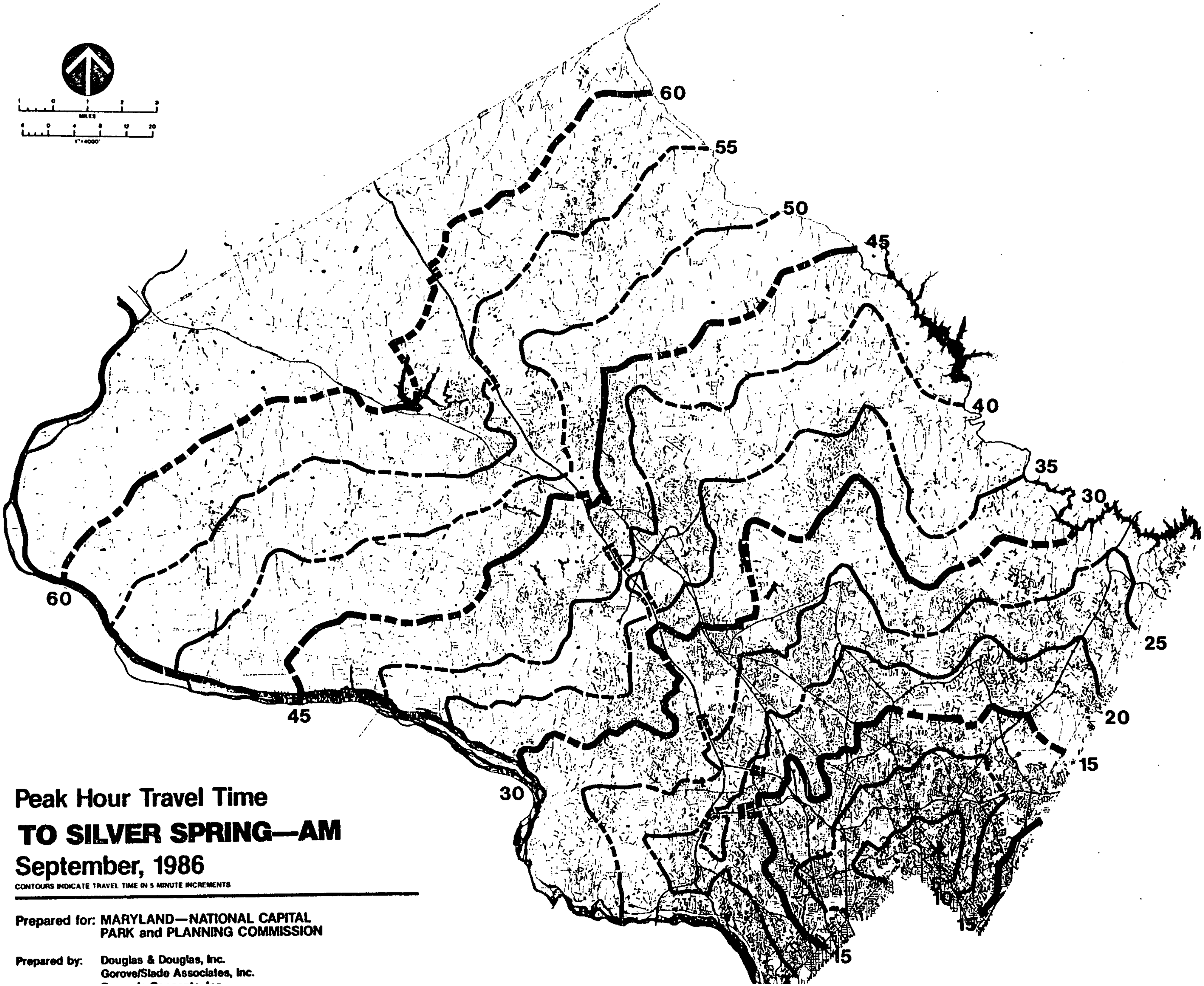

Peak Hour Travel Time
TO SILVER SPRING—AM
September, 1986

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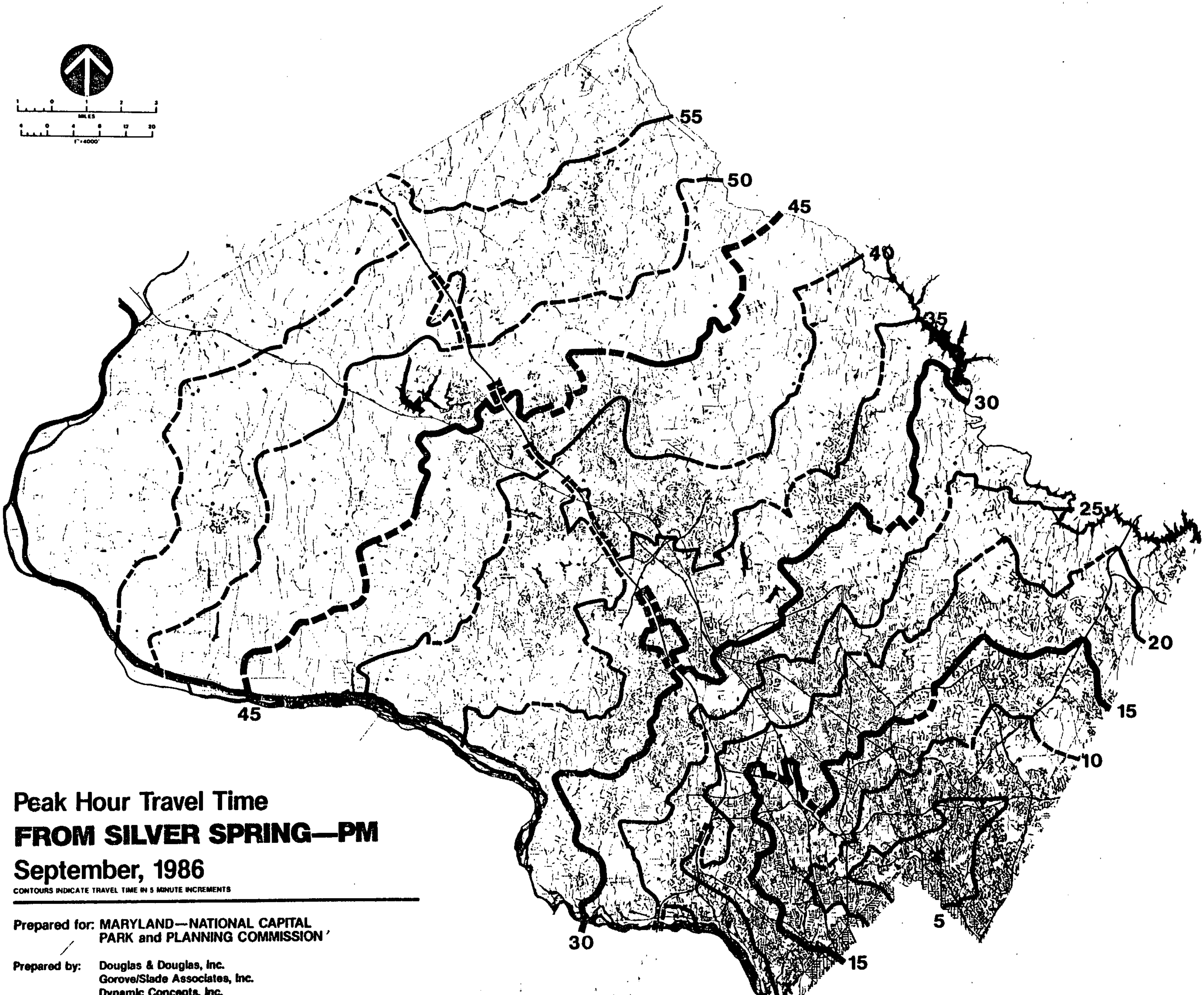

Peak Hour Travel Time
FROM SILVER SPRING—PM
September, 1986

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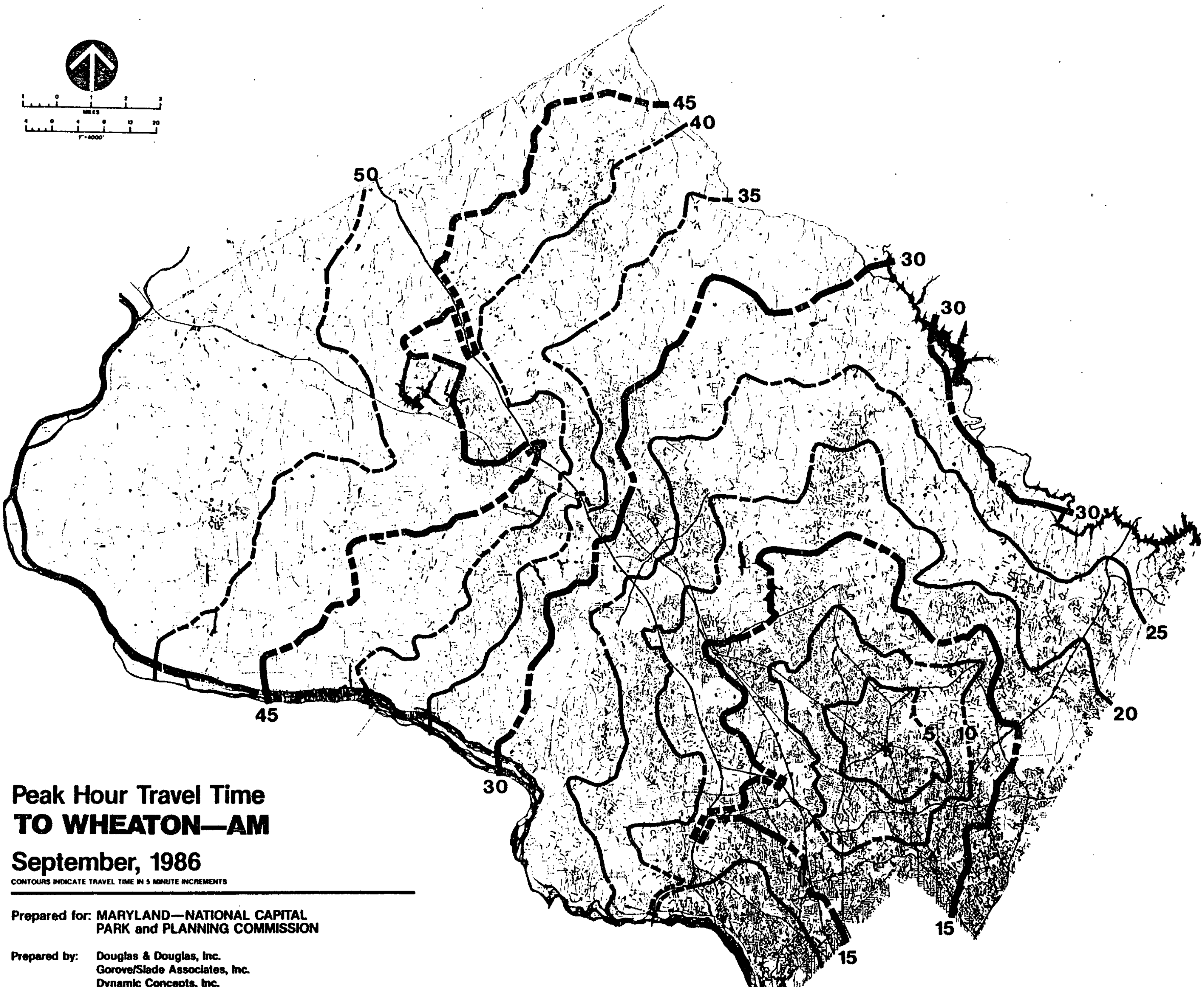

Peak Hour Travel Time
TO WHEATON—AM

September, 1986

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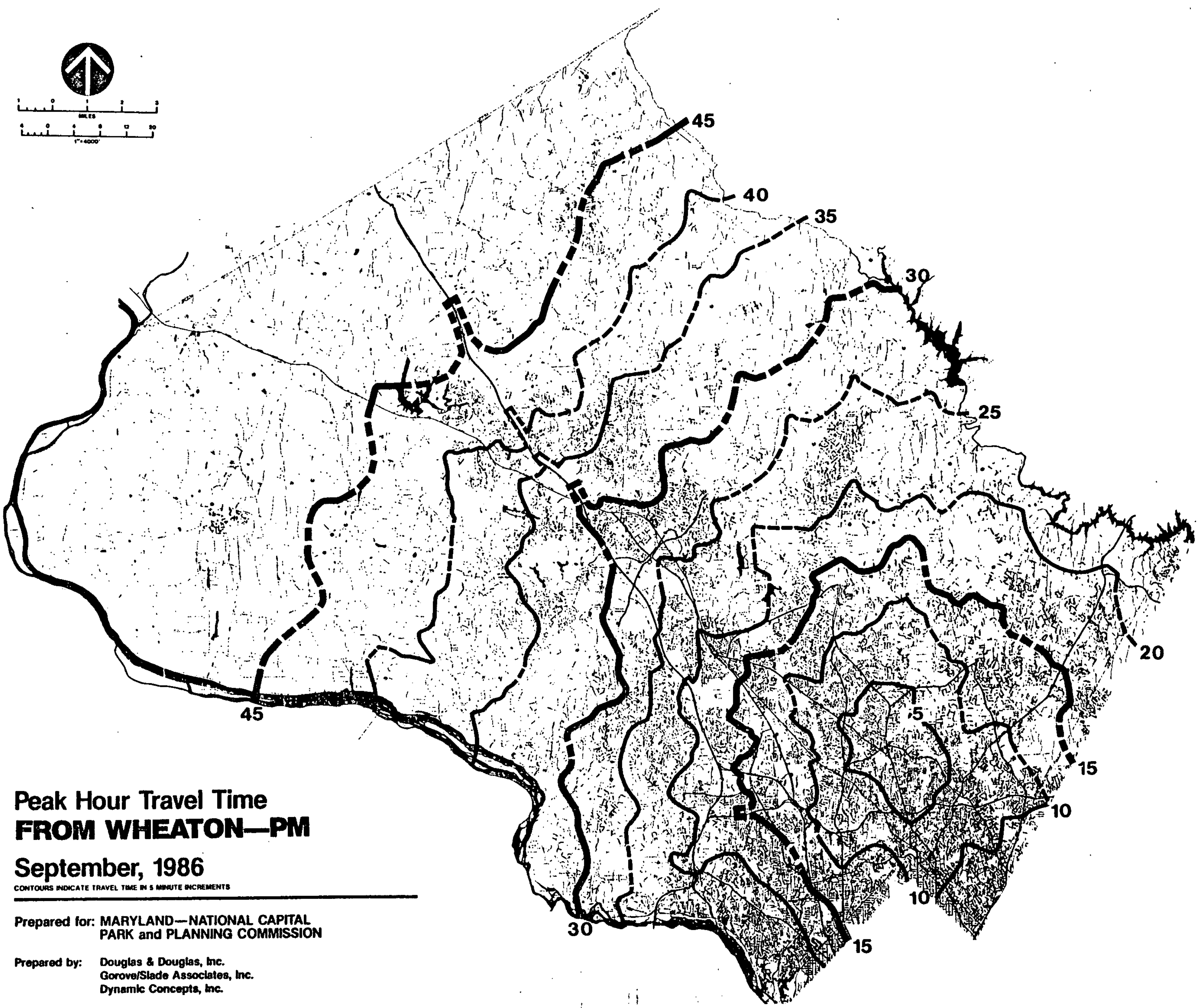

Peak Hour Travel Time
FROM WHEATON—PM
September, 1986

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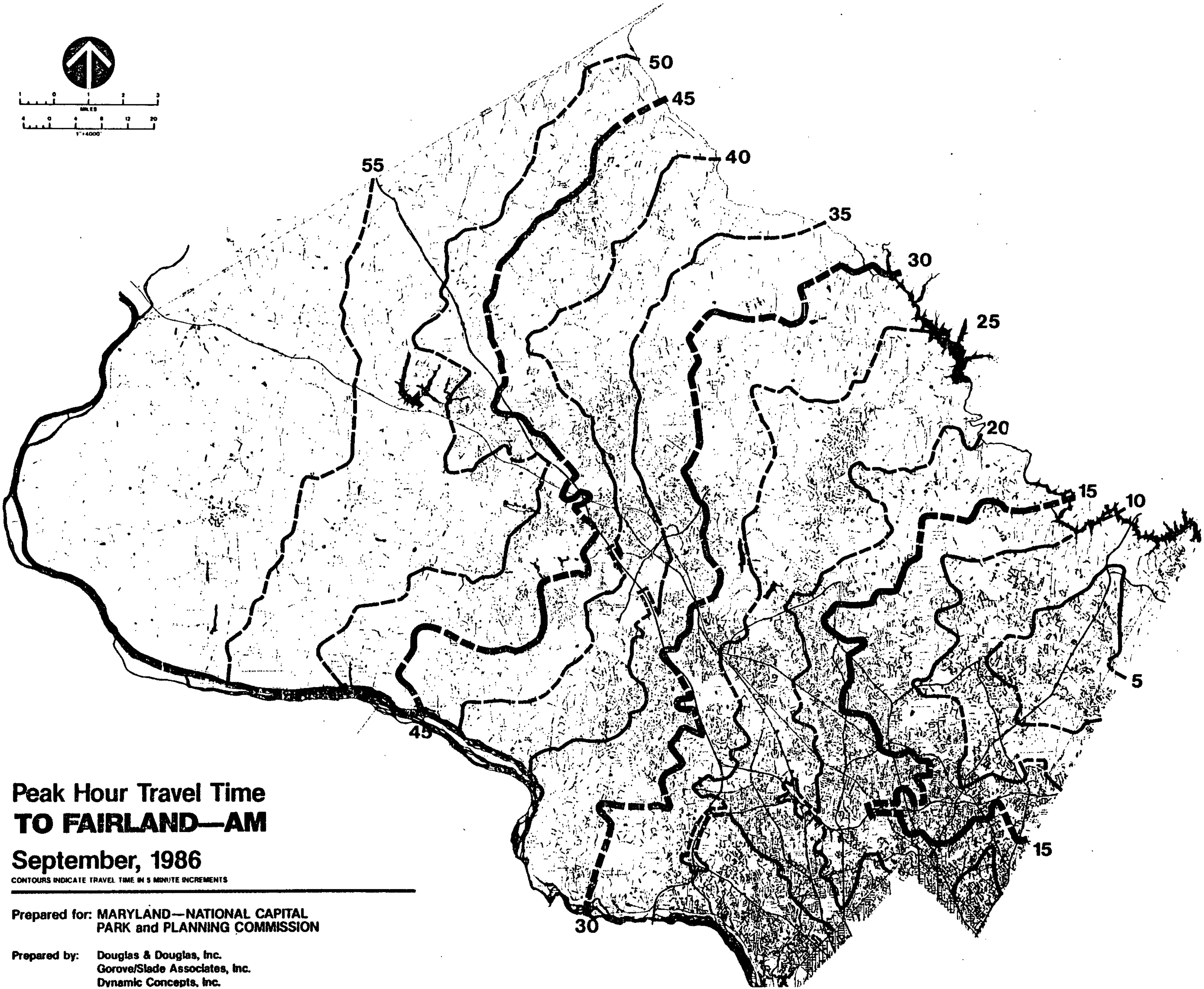

Peak Hour Travel Time
TO FAIRLAND—AM
September, 1986

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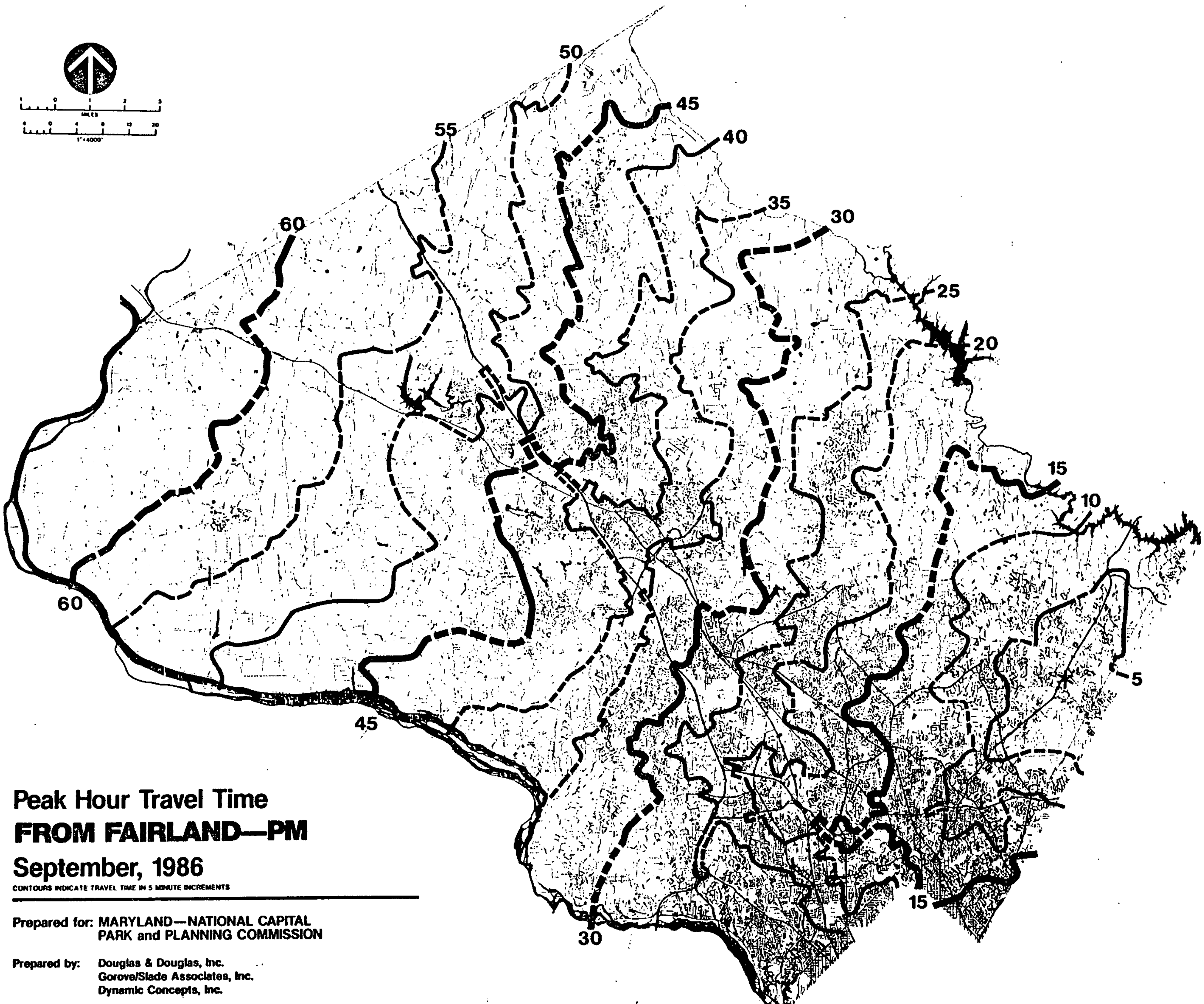

Peak Hour Travel Time
FROM FAIRLAND—PM
September, 1986

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